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EVOLUTION OF STREET PAVEMENTS

Few Materials in Vogue Thirty Years Ago Are Used To-day—Reasons for Changes—Adoption of Brick, Wood, Asphalt, and Other Bitumens—Properties and Costs

By GEORGE W. TILLSON, Chief Engineer, Bureau of Highways, Borough of Brooklyn, N. Y.

IF anyone interested in street pavements should take up the current reports of present city officials, he would be surprised to find how few of the materials in vogue thirty years ago are being used to-day. He would also find that the methods of construction have changed as widely as the materials themselves.

It may, therefore, be worth while to consider what circumstances led to the adoption of the original materials and also what caused them to be discarded after so long use.

There is no question that cheapness and availability were the governing conditions for many years, and the cobblestone filled these requirements to a nicety in all cities along the Atlantic Coast. Therefore we find that in Boston, New York, Brooklyn, Philadelphia, and Baltimore a large amount of this material has been used. In 1888, Brooklyn had 308 miles; Philadelphia, in 1884,

nearly 500 miles, while even now practically all of Baltimore's pavements are of cobblestone.

WHEN PAVEMENTS ARE NECESSARY

When roads become streets and traffic consequently increases, pavements are demanded. In early days Paris had a population of 200,000 and London, 90,000, when their first streets were paved. In these days it is not uncommon to find cities of 8,000 or 10,000 inhabitants with quite a number of paved streets. This difference is caused by the difference in civilization and the fact that previous to the seventeenth century practically all commodities were carried on packhorses or other beasts of burden. (In 1550 there were only three carriages in the city of Paris.)

A Swedish traveler, writing of New York City in 1751, says: "The streets do not seem so straight as those of Philadelphia and have sometimes considerable bendings;

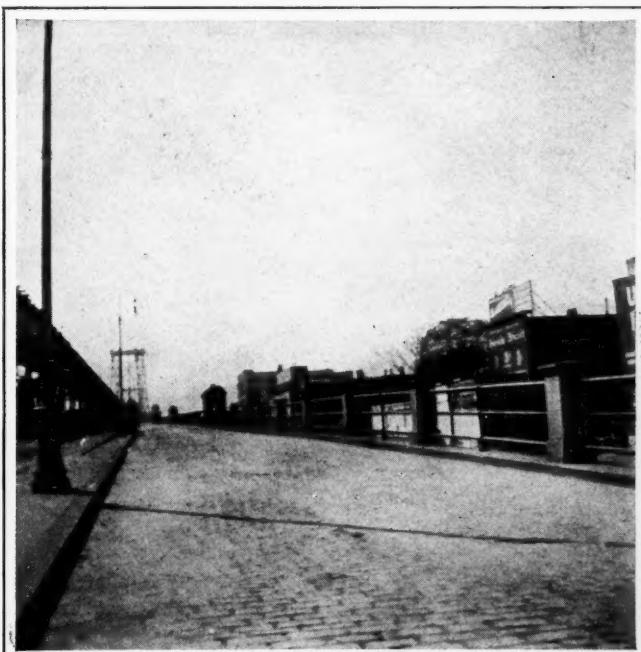


FIG. 1.—MEDINA SANDSTONE PAVEMENT; APPROACH TO WILLIAMS-BURG BRIDGE, BROOKLYN, N. Y.

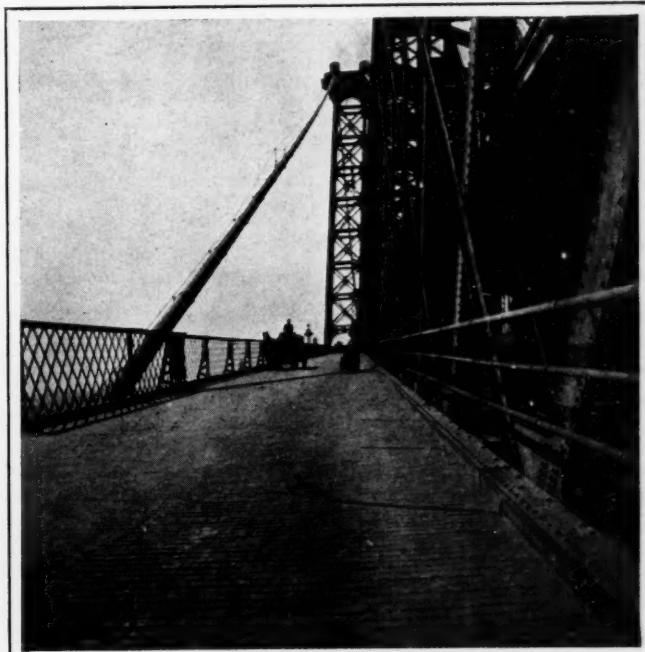


FIG. 2.—CREO-RESINATE WOOD PAVEMENT; MAIN SPAN, WILLIAMS-BURG BRIDGE, BROOKLYN, N. Y.

however, they are very spacious and well built, and most of them are paved except in high places, *where it has been found useless.*"

Denver, Colo., with its gravelly, sandy soil, thought for years that it would need no pavements, but when the growth of the city produced real traffic it soon changed its mind.

Omaha, Neb., constructed on an alluvial soil, probably required pavements as much as any city ever could, but it contained 35,000 people when its first real pavement was laid in 1882.

Now the general prosperity of the country is such that cities rarely reach a population of 20,000 without pavements.

MATERIALS USED FOR PAVING

The idea of availability and how any demand will be met is illustrated in the adoption and rapid increase of brick pavements. Stone suitable for pavements exists to a very small extent in the Central West, and consequently other material was looked for, and as a result an experimental brick pavement was laid in Charlestown, W. Va., in 1870. Very few engineers believed that a brick capable of standing heavy street traffic could be manufactured, but the ingenuity of the brickmakers has produced from the excellent clays of Ohio and Illinois a product that must be considered a standard paving material.

In the eighties it was thought that the well-known cedar block pavement filled a long-felt want, but a few years only were necessary to dispel that idea.

Many experiments, with varying results, have been made with different materials, in order to ascertain, if possible, what is the best kind of pavement under diverse conditions. Among the kinds used are stone, in many forms and shapes, wood, asphalt, coal tar, cement concrete, iron, brick, india rubber, shells, gravel, slag blocks, and even glass and hay. At the present time, however, the standard materials are stone, asphalt or other bitumens, brick and wood.

Stone is used in the well-known oblong blocks laid on a concrete base, the joints between the blocks being filled with gravel and its interstices in turn filled with coal tar; also as macadam, which needs no description. Asphalt is laid as a continuous surface and also in block form on grades that are considered too steep for sheet asphalt. The mineral aggregate is coarser than in the sheet, and the blocks are subjected to a pressure of some 5,000 or 6,000 pounds per square inch while hot. When the blocks are well made the pavement is very satisfactory.

A new scheme for improving sheet asphalt pavements has been recently patented in Washington. Steel grilles are incorporated into the asphalt before it is rolled. These grilles are made of steel bands in the form of what might be called an elaborate letter Z, one foot square. The bands are one inch wide and $\frac{1}{8}$ of an inch thick. After the wearing surface has been raked out on the street the grilles are heated and imbedded in the asphalt two inches apart, pressed down even with the asphalt, when the entire surface is rolled in the usual way. This treatment is supposed to make the pavement less slippery and more

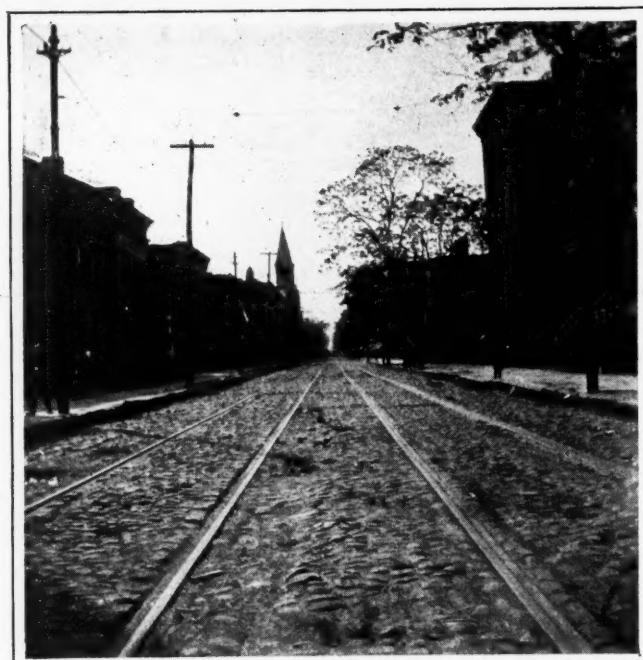


FIG. 3.—TYPICAL COBBLE PAVEMENT—STREET CAR TRACKS SHOWN

durable. It is expected that a block of asphalt pavement treated with these grilles will be laid in Brooklyn this season.

Another form of a bituminous pavement that has recently come into use, and very rapidly, is the so-called "Bitulithic Pavement." The patentee of this pavement started out to improve macadam, but the result of his studies is an elaborate street pavement which has been extensively introduced in the leading cities of the country during the past three or four years. It consists of broken stone from two inches in diameter down to impalpable powder, the sizes being so graded as to produce as few voids as possible, the whole mixture being bound together by coal tar specially refined for the purpose. When laid it looks much like sheet asphalt, but as it is composed of

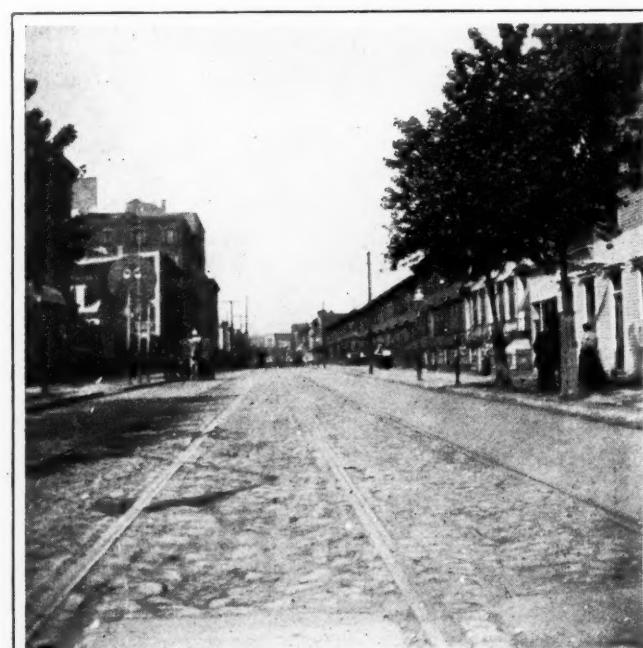


FIG. 4.—STREET WITH CAR LINE—SIDES PAVED WITH ASPHALT, TRACKS WITH COBBLE

larger material it is much less slippery. It is said to have been laid on grades of 10 and 12 per cent. with good results.

For some eight or ten years Indianapolis has been laying wood pavements, the blocks being specially treated with creosote oil to prevent decay. On account of faulty treatment, and perhaps faulty material, the first attempts were not satisfactory, the pavements bulging and breaking with wet weather. But with better and more oil better blocks have been produced. Creosote, however, is a volatile substance and more recently foreign matter has been added so as to increase the stability of the preservative. The so-called Kreodone blocks are treated with a mixture of creosote and a substance that is probably asphaltic. The creo-resinate blocks are treated with creosote and resin in equal parts, the specifications calling for twenty pounds per cubic foot of the mixture. The first pavement of this material was laid on Tremont street, Boston, about six years ago, and as yet shows very little wear. Wood makes a very pleasing material, as it is almost free from noise, and if the preservatives used will effectually prevent decay it is bound to be extensively used. Its greatest fault is its slipperiness, so it is adapted to light grades only. The particular kind of wood used is longleaf yellow pine. The Forestry Division of the Agricultural Department at Washington is planning extensive and elaborate experiments to determine if some other wood cannot be discovered which will produce as good results when treated. If the common woods will be satisfactory, the cost of the pavement will be greatly reduced, as the present demand for yellow pine makes it a very expensive material—so much so, indeed, that the finished wood pavement costs considerably more than asphalt.

Brick are used very extensively in the Central West, where the clays are particularly adapted for their manufacture and where other natural material is scarce. For small cities it gives good satisfaction, as it is durable, comparatively cheap, and can be easily repaired. Philadelphia is the only large city in the East that has any considerable amount of brick pavements.

Another form of pavement used in Europe and to some extent in this country is made of what is known as scoria, or iron slag blocks. This material is the product of furnaces for smelting iron ore and is run into moulds when hot, so that the blocks are regular and smooth. They are generally $3\frac{1}{2} \times 4 \times 8$ inches in size, with chamfered edges. Brooklyn has recently awarded a contract for about 4,000 square yards of this kind of pavement, in order to give it a fair trial. The blocks are laid in concrete with a sand cushion, the joints being filled with paving pitch.

EVOLUTION OF THE MODERN PAVEMENT

It is seen that the original pavements were required when the traffic became so great that the ordinary dirt surface would not accommodate it. That the first pavements were a makeshift, constructed of the most available material, which in this country was cobblestones. That as the business and wealth of cities increased, better

streets were demanded, and Belgian blocks were introduced as an improvement on cobble, which were soon supplanted on heavy traffic streets by the oblong granite block. But soon other requirements than those of traffic began to arise, the most important being sanitarness, smoothness, noiselessness, and the property of being easily cleaned. These last requirements can account for the rapid increase of asphalt pavements since 1890. In that year the cities of Boston, Brooklyn, Buffalo, New York, Chicago, Philadelphia, St. Louis, and Washington had 246.26 miles of asphalt pavement, and in 1906 it had increased to 1,633.66 miles.

Horses' feet make an appreciable amount of noise on asphalt, and the material requires constant attention to keep the pavement in repair, and chemically treated wood has been put forward to satisfy these faults. Wood blocks make an almost noiseless pavement. Experience must demonstrate their durability.

COST OF PAVEMENTS

After the properties of the different pavements are understood, the problem of applying them to the different streets to be improved presents itself, and its correct solution requires careful study. The first great consideration is that of cost. But, as a street once paved must always be kept so, the question of first cost only must not be considered. The life of the pavement and the expense of repairing are important items in determining the entire cost. And every city should, if possible, work with a view to ultimate rather than present economy. Some cities must often adopt a cheaper material than they would like, or go without, on account of their financial condition.

It is perfectly practicable to compare the different pavements with a view of obtaining the ultimate cost of each. At the present time, granite block pavement on a concrete base, with tar and gravel joints, costs in the Borough of Brooklyn, on an average, \$3.10 per square yard, and sheet asphalt about \$1.50 per square yard. Assuming,

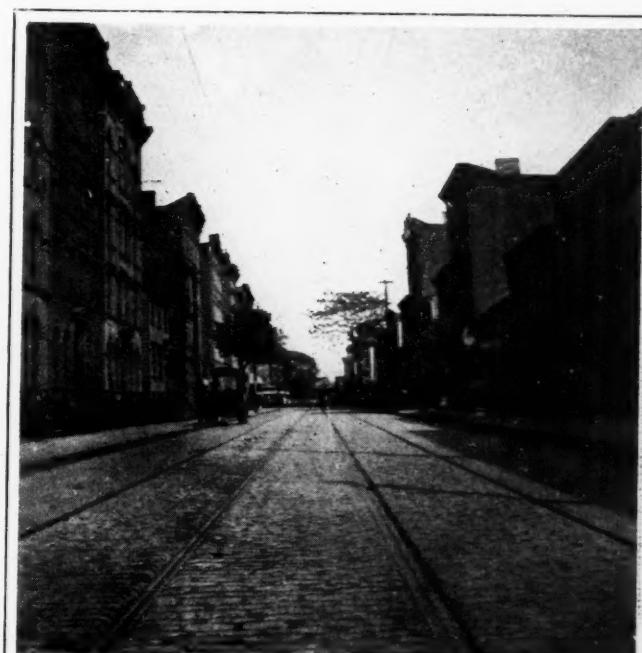


FIG. 5.—A CAR-LINE STREET—SIDES PAVED WITH ASPHALT; TRACKS WITH GRANITE ON CONCRETE, CEMENT JOINTS

then, that the life of the granite pavement will be 30 and the asphalt 18 years, the ultimate cost of the two is a simple calculation.

Let N =Life of the pavement.

C =Cost per square yard.

I =Rate of interest.

R =Estimated cost of repairs, if distributed over entire life.

A =Sinking fund to be paid each year to equal C at end of N years.

Then $A+CI+(R\div N)$ =annual expense of pavement.

In the above C and R are indeterminate and must be fixed arbitrarily. N has been settled. It is not so easy a matter to estimate the cost of repairing any pavement. The records of different cities are very deficient in that respect and the actual cost varies greatly, according to conditions. A granite pavement, as above described, on a resident street, if undisturbed by plumbers and corporations, would last fifty years with almost no repairs, while on a heavy traffic business street its life would be much shorter, even with considerable repairs. Illustrations of the above can be seen in Brooklyn, where a street subjected to traffic from the sugar refineries with street car tracks in the center, showed appreciable ruts after six months' service, although paved with the best granite that comes to the New York market. Another street paved in 1872 is in fairly good condition to-day. In this connection R will be fixed at 30 cents for granite.

The cost of asphalt repairs is also hard to fix. In 1904, the Borough of Manhattan paid 76 cents per square yard, in 1905, 34 cents, and in 1906 (it is estimated) 28½ cents to keep in repair its asphalt streets out of guarantee. Brooklyn paid 3½ cents, Omaha, Neb., 4¾ cents, Washington 2½ cents, and Toronto, Canada, 7½ cents per square yard; all for 1905, except Washington, the figures for which are for the year ending June 30, 1905. R for asphalt will be assumed at 54 cents.

Substituting in the equation for granite we have $\$0.06+\$0.1085+\$0.01=\0.01785 as the annual cost of a granite pavement for 30 years. For asphalt, the equation is $\$0.0612+\$0.0525+\$0.03=\0.01437 annual cost of asphalt for 18 years. That is, the annual cost of a pavement is a sum which, if deposited yearly, will amount to the first cost of a pavement by the time it is worn out, plus the interest on first cost and cost of repairs. But to relay the pavement when worn out will not cost as much as the original pavement, as the foundation need not be replaced. Assume the cost of relaying the granite to be \$2.35 and of asphalt \$1 per square yard, the equations for the second period will be $\$0.0455+\$0.0822+\$0.01=\0.1377 for granite, and $\$0.0408+\$0.035+\$0.03=\0.1058 for asphalt. The only uncertain factors in the above calculations are the life of the pavements and the cost of repairs. As no positive figures can be obtained for

these, their values will vary somewhat, according to judgment of the engineers.

AN ILLUSTRATION OF ENTIRE COST

A comparison of two paving contracts now in force for paving Broadway, Manhattan, will be of interest in this connection. Some few years ago Broadway above Canal street was paved with asphalt under a ten years guarantee at a price of \$5.69 per yard, not including foundation. There is now being carried out a contract for repaving Broadway south of the City Hall with creo-resinate blocks with a ten years guarantee, at \$3.08 per square yard, not including foundation, with a rebate of 10 cents per yard for the old pavement; making the cost practically \$3 per yard. In order to compare these costs fairly, it will be assumed that the bonds will be paid at the end of the guarantee period. The annual sinking fund and interest charge for asphalt will be \$0.6523 and for wood \$0.36 per square yard. Eighty per cent. of the asphalt price is paid when the work is completed and the remainder in five annual installments, beginning with the sixth year. This affects the interest charge, but not the total amount to be paid. As both of the above pavements are under guarantee for the same length of time, there will be no charge for repairs during the first ten years. Their relative values at the end of the guarantee period will depend upon their relative conditions and the future life of each. The paving of Broadway with wood is being carefully watched by municipal engineers, as they are much interested in the result. On such a street as Broadway the question of expense should not be considered if it is to interfere with the selection of the best pavement, as that street is entitled to the best pavement that can be had, irrespective of cost. It would seem that on this street it will be easy to compare the relative merits of asphalt and wood under heavy traffic, although in this particular case the wood pavement will undoubtedly be subjected to the heavier traffic.

Both contracts call for the pavements to be turned over to the city in good condition at the end of ten years, and upon the length of time they will last after that and the cost of repairs will depend their relative values to the city.



FIG. 6.—SCORIA BLOCK PAVEMENT, ROTTERDAM, HOLLAND

ISSUING BONDS FOR PAVING

The question of the annual cost of pavements is important to all municipalities, but especially so when they are paid by bond issues. No city should issue bonds without a proper provision for a sinking fund. By the use of the formula previously presented, the proper amount to be provided in the annual budget can be ascertained. It would seem that the bonds should be issued for the length of time the pavement is expected to last, say 20 years for asphalt and 30 years for granite pavements. If bonds are issued for longer periods, the city will be put in the position of having a pavement worn out before it is paid for, which is certainly bad business. If the monies collected each year are kept in a special fund, when a pavement needs relaying the work can be done and paid for without increasing the indebtedness of the city. In this way actual results, varying as they must from theoretical, would be averaged, as the loss on one street would be made up on another unless the calculations were grossly incorrect.

Municipal officers, in trying to obtain data on any subject, are always struck with the extreme difficulty in obtaining their information. This results from two causes—first, the lack of system in keeping accounts; and second, the indifference of officials.

UNIFORM ACCOUNTING

The first defect is gradually being corrected, but few cities realize even now the importance of keeping a record of exact costs, and some, perhaps, do not care to. It is often said that it will not pay, that it is too great a refinement to itemize and analyze the cost of street repairs, for instance. But when it is remembered that the present wonderful economical methods of manufacturing at the present time have been brought about in just that way, and that manufacturers who do not systematize their cost records cannot live, the force of this argument is lost. Then, too, the work can often be done without any extra help, as the regular clerks will find that by the use of a definite system greater results will be obtained in less time.

But the indifference of city officials is not overcome so easily. Where the tenure of office is short and depends upon what political party is in power, men cannot be expected to attempt a system that takes years to work out if they do not expect to remain in office until its completion. But a great deal can be accomplished without much trouble, simply by co-operation. Some time ago the Municipal Engineers of the City of New York appointed a special committee to obtain data as to the cost of repairing asphalt pavements. Blanks were sent out to nineteen of the principal cities of the country, with the request that they be filled out, together with the statement that a copy of the report would be sent to everyone replying. Responses were received from only a few more than one-half, and something definite from a portion only of these. In several cases lack of data was the cause, but a surprising amount of indifference was shown.

City officials should work together and arrange their work so that results in one city would benefit another. They should mingle more with each other and learn new methods.

PAVING MATERIALS AND METHODS

In the United States—Brick Pavements and How Manufactured—Asphalt and Macadam—Wood and Stone Blocks

THE MUNICIPAL JOURNAL recently sent to the various paving companies throughout the country a request for information as to the cost, duration, places where used, and special features claimed by each for their respective goods. An effort is made to present herein a digest of the replies for the benefit of our readers. While this is compiled from these reports and its absolute reliability is not vouched for, still it is believed to present, in the main, a fair brief for the various classes of pavements. If any have been omitted, it is because the names of their manufacturers or promoters were not known, or because of their failure to reply to our inquiries.

It may be said in introduction, that pavements are of two classes—those whose surfaces are composed of blocks, generally rectangular; and those in which a continuous surface is formed of particles bound together either by their own cohesion or by some other substance. The latter we have classed as sheet pavements. Thus, in a macadam pavement, the binding material is dust and water; in an asphalt, it is bitumen; in concrete, it is cement.

BLOCK PAVEMENTS

Brick pavements are manufactured from either shale or fire-clay, each claiming superiority to the other in certain points. They are now almost invariably laid on a concrete foundation, and either a sand or bituminous filler used between the bricks. The cost of brick naturally varies with the locality, but seems to lie between 50 and 77 cents per square yard for brick only, at the kiln, the average being 62 cents. The cost of finished pavements must be still more variable, depending upon freight rates, class of foundation, filler, etc., used, and conditions of guarantee; but is given as ranging between \$1 and \$2.30 (the latter in California), the average being \$1.51, the majority of prices being between \$1.25 and \$1.75.

Estimates concerning the life of brick pavements vary widely. (In this connection it must be noted that the life of any pavement is shortened fully 50 per cent. by removing and relaying the same for opening trenches in streets. In fact, few modern pavements have legitimately worn out, although some have disintegrated because of chemical or mechanical defects. One of the most important considerations connected with street paving materials, and one on which there seems to be few data, is their relative capacity for being taken up and relaid, and the effect of this on the character and life of the pavement.) Estimates of the life range from 15 to 100 years, several cases being cited of pavements 15 or 20 years old and good as new; certain firms offering 25-year guarantees, although 10 years is more common.

The advantages claimed are: Durability, low cost of construction and maintenance, smoothness, good appearance, that the pavement can be taken up and replaced easily and successfully, is not affected by heat or cold, by oils, gas, or water, is not absorbent or permeable, and is therefore sanitary, and that the material is widely distributed.

Wood blocks were used many years ago for paving, but were found to be porous, wore unevenly and rapidly, and possessed other defects which caused their disuse as soon as better material was found. But the modern wood block is entirely different from the old, the blocks being of carefully selected hard-wood, and rendered durable by creosote, resin, or other injected materials, and laid upon a concrete base.

Creosoted blocks 3 inches deep cost \$1.50; 3½ inches, \$1.65; and 4 inches, \$1.85 per square yard, at the works. Creo-resinate blocks cost from \$2 to \$3, according to depth. The completed pavement is said to cost \$1 per square yard additional. The estimated life is given as 15 to 30 years, but the modern block has not been laid long enough yet to demonstrate this. Some of the older creosoted blocks, however, have been in service for over 20 years, and creo-resinate blocks laid on one of the busiest streets of Boston in 1900 show little or no signs of wear.

The advantages claimed are: durability, noiselessness, smoothness, good appearance; that the pavement is sanitary; can easily be taken up and replaced; is not affected by water, and is not absorbent or permeable.

This pavement is in use in Boston, Baltimore, Springfield, Minneapolis, Duluth, Chicago, Indianapolis, Toledo, St. Louis, Cleveland, and other cities.

Stone blocks were among the first paving materials to be used, and any recent improvement in them has been in the character of foundation and kind of stone used. The older pavements were almost invariably laid on sand or gravel foundations, but of recent years many cities have adopted concrete for these as well as for other pavements. Granite has been used most generally for stone blocks, but certain sandstones have recently demonstrated their advantages, and the use of them is increasing rapidly. Sandstone blocks cost about \$1.50 per square yard at the quarry; the complete pavement costs from about \$2.65, including base, to \$2.80, exclusive of base (the latter 500 miles from the quarries). The life of Medina, Kettle river, or other tough sandstone, is probably at least as great as that of any other material, except the best granite.

The advantages claimed are: durability, that they are not affected by heat, cold, oils, gas, or water, that they are not absorbent or permeable, are sanitary, smooth (the pavement is much smoother than granite, not wearing "cobblestony" on top), gritty, affording a good foothold, and are silent as compared with granite or brick.

Sandstone blocks have been laid in Brooklyn, Cleveland, Rochester, Buffalo, Columbus, Utica, Elmira, Syracuse, Toledo, St. Paul, Minneapolis, Duluth, Superior and other cities.

Asphalt blocks, composed of crushed stone and asphalt, were made by hand as early as 1869, but were not a success until compressed by powerful machinery, which has been used since 1880. In the first blocks limestone was used, but since 1893 traprock has taken its place, greatly increasing the durability. The cost of this pavement complete is given as about \$2.25 a square yard.

The advantages claimed are: smoothness, good appearance, that it is not slippery, absorbent, or affected by temperature, is sanitary, noiseless, and easily taken up and relaid.

Asphalt blocks have been laid to the extent of more than 50,000 square yards in each of the following cities: Alliance, Baltimore, Chester, East Pittsburg, and New Castle, Pa., Manhattan, Bronx, and Brooklyn, New York, Salem and Toledo, O., Washington, D. C., and Youngstown, O., and in smaller quantities in more than 100 other cities of the United States.

SHEET PAVEMENTS

Asphalt paving has undoubtedly been used more extensively than any other sheet pavement unless we consider macadam as a pavement. Asphalt serves in this pavement as the binding material only, the actual wear being taken by the sand, of which there is about six times as much as of the asphalt. It might be considered, therefore, that this is really a sand pavement, with an asphaltic binder; and therefore that the principal constituent was found generally scattered throughout the country. Until within a few years practically the only asphalt used was a fairly pure bitumen found in the form of a plastic solid; but for several years asphalt has been obtained by refining the asphaltic oils of California, and also from asphalt-bearing rock, which has seemed to give excellent satisfaction for paving purposes. Rock asphalt, a natural mixture of bitumen with sand and certain other substances, has had considerable use for paving (being, in fact, the material originally used for this purpose in Europe). It is broken into small pieces, spread in place without heating, and rolled with a heavy roller, which causes it to flow and cohere into a solid sheet.

No price of either the material or the pavement was given by our informants. The estimated duration of the ordinary sheet asphalt is given as 15 or 20 years; and a longer life is claimed for rock asphalt.

The advantages claimed for sheet asphalt generally are: durability, smoothness, noiselessness, and that it is sanitary, presents a good appearance, and is not absorbent or permeable. Bermudez asphalt is claimed not to contain soluble salts, and therefore to be unaffected by water, and to contain 95 per cent. or more of bitumen; Obispo California asphalt claims the same; for rock asphalt it is claimed that there are no soluble salts, that considerable coarse sand therein makes it less slippery than ordinary sheet asphalt, and that the laying is less difficult and expensive. California oil asphalts are said to contain a higher percentage of bitumen (99 per cent. or more), and be more uniform in composition than "natural" asphalts, and to make equally good pavements.

USE OF SHEET ASPHALT

Sheet asphalt has been laid in most of the larger and many of the smaller cities of this country, it being stated that 6,000 miles of streets have been so paved at a first cost of \$200,000,000. Probably the largest part of this was Trinidad asphalt, but Bermudez asphalt is now being widely used in all the larger cities; California natural asphalt has been used in New York, Chicago, Buffalo, and twenty other cities; California oil asphalt is being used in New York, Newark, Buffalo, Detroit, Pittsburg, and other cities; Acme asphalt, obtained from asphalt rocks, has been used in Utica, Boston, Omaha, Davenport, Auburn, Yonkers, St. Joseph, Newark, and other cities; and rock asphalt from Indian Territory has been laid in Kansas City, St. Joseph, Sedalia, Little Rock, Fort Worth, Austin, and Memphis.

Bitulithic pavement might be called a cross between an asphalt and a macadam. It is, in fact, a macadam in which hard crushed stones are so carefully graded in size that there is less than 8 per cent. voids in the resultant mass, which are filled with specially prepared bitumen, thoroughly mixed in. The combination is spread and rolled like macadam, but no fine "binder" is used, the bitumen serving that purpose. Since there is no binder dust and the stones have almost no motion among themselves, practically no dust is created by the pavement, and the binder does not wash out. Concrete foundation is advisable in yielding soils.

The cost of bitulithic pavement ranges from \$2 to \$2.40, depending upon the local price of suitable stone, which forms 92 per cent. of the material used. The life is assumed to be equal to that of a block pavement of the same kind of stone.

Nearly 4,000,000 square yards of this pavement are in use in 106 cities, including Boston, Lowell, Salem, Scranton, Allentown, Birmingham, Nashville, St. Louis, Cincinnati, Milwaukee, and Portland, Ore.

The advantages claimed are: durability, imperviousness, that it is smooth, but not slippery, is free from dust or mud, unaffected by heat, cold, or water, is sanitary and presents a good appearance.

Wadsworth macadam is constructed like ordinary macadam, but in place of the customary top dressing of stone screenings is placed an inch of crushed Kentucky rock asphalt. When rolled this is similar to a thin layer of rock asphalt pavement on a macadam base, or to a macadam with asphalt instead of dust as a binder in the top layer. The cost is said to be from 10 to 20 cents more than ordinary macadam (depending on freight rates); the duration twice as long. It has been introduced but about a year, and is used in Birmingham, Memphis, and Bowling Green. The advantages claimed are: durability, freedom from dust or mud, that it can be washed without "raveling," and remains smooth.

The Hassam pavement is constructed by pouring upon a concrete foundation a thick cream grout of sand and cement, which is then filled with pea stone and rolled at once. The cost was not given. It has been used for a year in Worcester, Mass. The advantages claimed are:

durability, economy; that it is sanitary, smooth but gritty, and of pleasing appearance.

The above does not include macadam, which is more widely used, cheaper, and less durable than any of those mentioned; it is also absorbent, permeable, and washes badly. It is better than the natural soil in most cases, however, and its cheapness overshadows its defects for many localities.

There are certain treatments of roads approximating to the Wadsworth macadam, such as oiling with California asphaltic oils, tarring with "Westrumite," "Tarvia," and other preparations of coal tar. This can hardly be called paving, however; neither can the laying of steel wheelways, several patterns of which are being advocated; and if there be added to the above list a few other kinds of material which may be found referred to in other columns of this issue, it is believed that the presentation is practically complete.

ASPHALT FOR PAVING

The California Product Successfully Used Over Wide Territory—Low Cost of Maintenance—New York City's Experience

By FILLMORE CONDIT

THE history of the asphalt paving industry has been crowded with dramatic incidents and startling developments. Fragments of asphaltic rock, falling upon a road in a Swiss valley and leading to the discovery of its value for pavements; the paving of a Paris boulevard and of Threadneedle street; the experiments of De Smedt with Trinidad asphalt; his invention, patents and paving of Pennsylvania avenue; the acquisition of Trinidad Lake by Amzi L. Barber, and his successful plea to the Privy Council of England not to allow Trinidad Lake to be opened to free trade; and the contests, legal, diplomatic, and with armed men, over the Bermudez deposit—these are but a small part of the unwritten story of a great industry.

For twenty-four years after De Smedt laid his first strip of pavement in Newark, N. J., it was generally considered that Trinidad Lake, the Bermudez deposit, and the almost exhausted Alcatraz deposit of California constituted the only available sources of supply of a paving material which the most important cities in America were demanding in immense quantities. Between 1900 and 1904 it developed that, instead of our country being dependent upon South America for its paving asphalt, a single State, California, can easily supply, not only sufficient asphalt for the needs of our own cities, but an amount greatly in excess of the entire paving requirements of the civilized world.

More than ten years ago small amounts of asphalt obtained from refining the asphaltic oils of California were successfully used in paving, but as the production was small it attracted little attention. The production of as-

phalic petroleum of California, which was about 300,000 barrels in 1895 and 500,000 barrels in 1898, increased in 1905 to 29,700,000 barrels. As it contains an average of over 25 per cent. of pure asphalt, if this oil had all been refined, it would have yielded 7,425,000 barrels, or 1,856,000 tons, of that material. The present indications are that the petroleum production of California will increase and can probably be depended upon to produce 2,000,000 tons of asphalt annually for an almost unlimited time. As the present entire consumption of the material in our country is only about 200,000 tons annually, it can easily be seen that our nation might be able to get along for a time if some unforeseen international complication should prevent the importation of paving asphalt.

History seems likely to repeat itself. Elderly people remember when the hardware and cutlery in our stores were stamped with the names of Birmingham and Sheffield makers, when in our dry goods shops the magic word "Imported" was synonymous with excellence, when no engineer caring for his own reputation would consent to the use of any cement unless made in other lands.

SUCCESSFUL HOME PRODUCT

If the gradual displacement of South American asphalt continues, if present indications are not erroneous, the importation of asphalt for paving purposes will entirely cease within five years. Of course, the reliability of California asphalt has been questioned, but its reputation is becoming thoroughly established. Successful pavements have been laid with it in New York, Newark, Jersey City, Trenton, Cleveland, Chicago, Cincinnati, St. Louis, Kansas City, Buffalo, Rochester, Detroit, Denver, Omaha, New Orleans, Salt Lake City, Toronto, Tacoma, Seattle, San Francisco, Los Angeles, and many other cities.

Five paving companies have paved with it over four hundred streets and parts of streets in Greater New York alone, aggregating almost two million yards.

California asphalt fits the description of a perfect paving asphalt as formulated by De Smedt a quarter of a century ago. It is purer chemically than any competing material, and is less affected by water. Owing to its purity, a ton of it will pave more yards than an equal weight of so-called "natural" asphalt. It requires less care in sand grading, and less skill to produce durable and long-lived pavements.

In New York City, the streets paved with California asphalt are in better average condition than those paved with other varieties, and less expensive for contractors and highway departments to maintain.

Owing to low cost of maintenance, companies using California asphalt took contracts for paving with it in New York City in 1905 at from 74 to 80 cents per square yard, prices lower than any at which high-class pavements have ever before been laid in America or any other country. Defective pavements may be made of any asphalt, poor bread with the finest flour, but with ordinary skill and reasonable care, California asphalt never fails.

CEMENT FOR SIDEWALKS

Milwaukee Convention Addressed by R. W. Lesley—
History of Industry—Building Construction
—American Product

MR. R. W. LESLEY, who has had probably unique opportunities of watching the use and growth of the cement industry, expresses the hope that the experience gained by himself and his associates might prove of value to the Association. Not that the manufacturers of cement claim any superiority due to the long period over which their observation had extended, but that they have had a wide and varied experience within a comparatively short time. The rapid increase in the consumption of cement in the past is likely to continue in the future. For with the rapid disappearance of our forests—each tree having the same unit of value in building as two barrels of cement—wooden building construction must have a diminishing importance in the future. For other reasons, too, fireproof construction is increasing in favor and among qualities desirable for such work cheapness and ease in handling will not be overlooked.

The cement user has a duty to the public, the latter risking their property and lives in buildings constructed of cement. The history of the cement business is not without its teachings. In the early days, when all cement was imported, the material was so scarce and expensive—five dollars a barrel—that the cement worker put labor of equal value into his work. One example of this sort of work remains, a monument to the integrity of its builder, a sidewalk at the Broad Street Station in Philadelphia, over which a number of people, estimated as equal to the whole population of the United States, has walked. At a later period work was often slighted, until the business reached a low point three or four years ago, when it was revived by a change in manufacturing methods.

In concrete building construction good work is even more important than in sidewalk construction. That little is known by the public about this class of building, is evident from an incident recently recorded in a newspaper account of a collapsed concrete floor, in which the contractor is represented as saying that the floor was of a "new type, made to do away with any bar, girder, beam or support." The building of houses of concrete blocks is even more recent in its development than reinforced concrete.

It is said that Portland cement could not be made in this country; it is claimed that suitable materials for its manufacture do not exist. When cement was first made here, if faults developed in work in which it was used, the blame was always laid to the inferiority of the cement. Such charges led to a general demand for standard specifications for cement. A committee was appointed in which members of the American Society of Civil Engineers, the Cement Manufacturers' Association and the Fire Protection Association united to draw up specifications.

A FAILURE OF TARRED MACADAM

Expensive Experiment at Fredonia, N. Y.—An Object Lesson to Other Cities—Inexperience or Specifications to Blame

THE expensive experiment, made in paving Central avenue, Fredonia, N. Y., should prove a most valuable object lesson, teaching first the fallacy of placing inexperienced men in charge of expensive construction, and second, the necessity of strict adherence to such plans and specifications as have been set forth in placing the work under contract. The failure of over a mile of tarred macadam there has been due more to a lack of proper experience in this construction and slack insistence on compliance with specifications, than to any inherent defect in the class of pavement specified. The work was completed six years ago, but has needed such constant repair that the "Fathers" are now considering resurfacing the entire structure with asphalt.

The pavement was built from specifications closely following similar work which has made a good showing in Hamilton, Ont. The sketch shows the general structure of the pavement called for by the specifications. The failure was in the top course of tarred gravel. The third course of tarred rock was allowed to project through the top course of tarred gravel; the latter being put on too thin, and rolled entirely into the third course of tarred rock, forming a light and inefficient binder with the rocks of the third course plainly visible at the top of the pavement when finished and accepted. In fact, the one-inch gravel course was not put on except in such places as

where the third course was accidentally too low, and the gravel course was used to reach the grade line. Where such fortunate errors were made the pavement is still in perfect condition. Other parts of the surface have disintegrated and the pavement is full of holes to such an extent that the street must be resurfaced. The good spots stand as evidence that if the specifications had been strictly complied with the pavement would still be giving satisfaction.

Within two years after the pavement was laid it was necessary to spend upward of fifteen hundred dollars (\$1,500) for repairs. Each year thereafter a like amount, more or less, was expended for repairs until last summer. At that time the street was so full of holes and so thoroughly disintegrated that the street commissioner simply raked out the loose stones and débris from the holes and filled them with common gravel. This spring the street is beyond repair, full of holes, littered with stones, and such a disgrace that a petition is now being circulated for the purpose of repaving with something durable and substantial.

The original cost of this pavement per square yard was \$1.06, to which was added 25 cents per cubic yard for excavation. The main streets of the village are paved with brick, which is giving satisfaction, with the exception of one short piece of paving on Main street—the first built in the village—constructed as Telford, which is in bad condition.

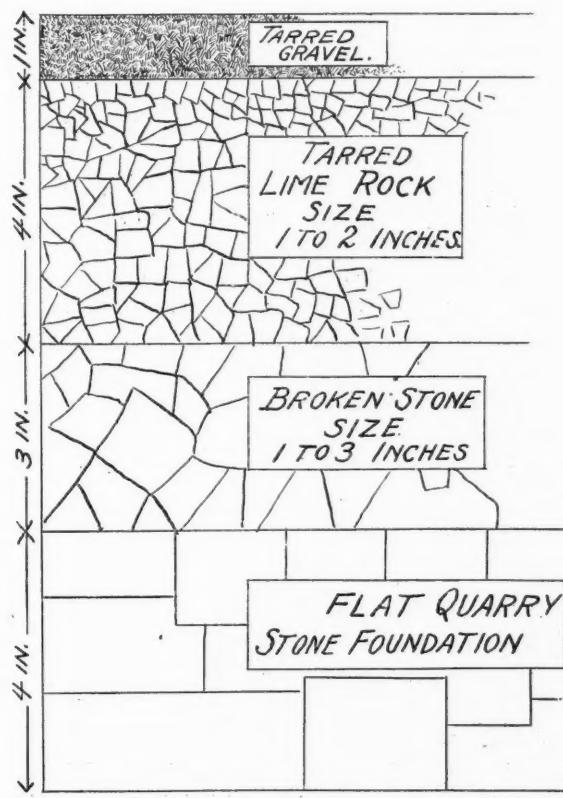
SPECIFICATIONS

The tarred macadam was put in under the following specifications:

Laying the Foundation—Upon the subgrade, 12 inches below the finished grade line, prepared as specified, shall be laid by hand over the entire width of roadway a course of good, sound, durable flat quarry stone, not less than 3 inches thick, laid to a depth of about 4 inches. Each stone shall contain not less than $\frac{1}{2}$ nor more than 2 feet of flat surface. Stones closely fitted, spaces to be filled with shale and rolled with a ten-ton roller. Should any depressions appear, more stone shall be added and the rolling continued until the entire roadway shall be hard and compact, the same to be brought to a true crown and grade of the road as shown on the plans.

Second Course—Upon the first course shall be laid a second of broken stone, the size of which shall not be greater than will pass in any direction through a 3-inch ring, and no stone that will pass in any direction through a 1-inch ring. When 300 feet have been laid the same shall be rolled with the above specified roller, and should any depression appear, more stone shall be added and rolling continued until the said first and second courses together shall have a thickness at all points of at least 7 inches and are brought to a true crown and grade of the road, and are hard and compact, and to be 5 inches at all points from finished grade line.

Third Course—Upon the second course, above specified, shall be laid a layer of flint limerock to measure in depth 4 inches after being thoroughly rolled. Size of rock shall not be greater than will pass in any direction through a 2-inch ring, and no stone that will pass in any direction



SECTION SHOWING TARRED MACADAM
(Fredonia, N. Y.)



CENTRAL AVENUE, FREDONIA, N. Y.
(Tarred Macadam.)

through a 1-inch ring. Said rock, when deemed necessary by the engineer, shall be heated upon an iron floor under which are flues from a fire, until the moisture is driven out. The stone, when heated as above specified, shall be thoroughly mixed with pure coal tar and shall be turned with shovels until every particle of stone shall be coated with tar. The tar shall be boiled in iron kettles holding at least 50 Imperial gallons. Ten gallons of hot tar, or a sufficient quantity to thoroughly coat said stone, shall be added to every cubic yard of stone and shall be turned and mixed as above specified. After being thoroughly mixed, it shall remain undisturbed for 48 hours, then spread over as above specified, and when 300 feet has been laid it shall be rolled. Should depressions appear, more tarred stone shall be added and the rolling continued, until the entire roadway shall be hard and compact, the same to be brought to a true crown and grade of the road as shown in plans, and to be one inch at all points from the grade line.

Gravel Course—Upon the tarred stone, above specified, shall be spread a one-inch layer of tarred gravel. The gravel shall be pure, clean, screened beach or bank gravel. The size shall not be larger than will pass in any direction through a 1½-inch ring. The gravel is to be heated and dried in the same manner as the stone, and mixed with pure coal tar, tar to be heated to a temperature of 250° F.



EAST MAIN STREET, FREDONIA, N. Y.
(Telford Macadam.)

From 12 to 14 gallons of hot tar, or a sufficient quantity to thoroughly coat said gravel, shall be added to each cubic yard of gravel, and the same shall be thoroughly mixed and turned with shovels until every particle of gravel shall have become coated with tar. It shall then remain undisturbed for at least 48 hours, and then spread upon the tarred stone. When 300 lineal feet shall have been spread it shall be rolled with roller above specified, and the rolling shall be continued until it shall be hard and compact, and brought to the true crown and grade of the street.

Top Dressing—Upon the gravel course shall be spread a thin layer of rock screenings which shall be spread and rolled to the satisfaction of the engineer.

The Tar—No tar shall be applied to any batch of stone or gravel until the same has been inspected by the engineer.

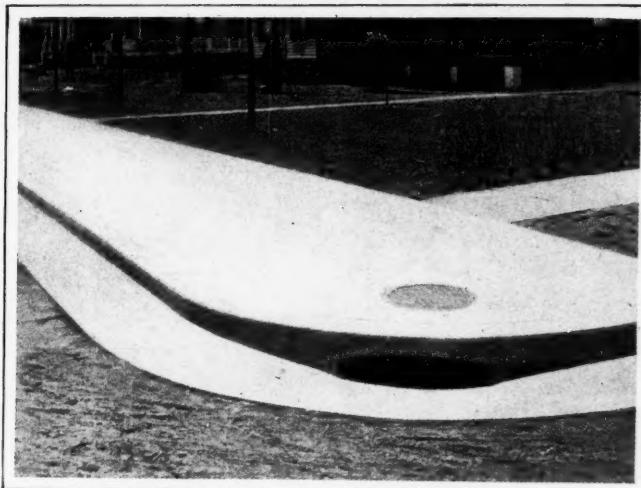
STREET CURBING

Importance in Municipal Work Calls for More Attention to Details—Materials Used and Costs— Admirable Features

To obtain a perfect and permanent alignment of street curbing is the aim of municipal engineers of the present day. But where custom has established the use of thin and sometimes inferior local stone, of short lengths, we see an irregular line of curbs which destroys the whole effect of the improvement.

This faulty curbing, improperly set, is in such general use that it is considered by property owners as a natural one, to be corrected by frequent repairs. In New York it has become the practice to call for bluestone curb of not less than 3½-foot lengths, 5 inches in thickness and 16 inches in depth when bedded in concrete, and 19 inches in depth when bedded in sand. Stone curb, as specified above, set in concrete, can be made to hold its alignment, but when set in sand is subject to disturbance by frost or impact of heavy weights. In both instances the exposed sharp edge is subject to spalling by the frequent backing of heavy vehicles against it, and in a short time presents a ragged edge.

A steel bound concrete curb, known as the Wainwright curb, has been in use a number of years by the Bridge Department, Borough of Brooklyn, Queens, and in other places. It is bound by a soft steel galvanized bar, properly anchored in the concrete, which protects the edge of the curb from spalling. The curb is constructed in ten-foot lengths, with joints to provide for expansion. The usual dimensions are 6 by 18 inches,



CONCRETE WALK, GUTTER AND CURB
Ocean and Church Avenues, Brooklyn, N. Y.

although, if required, these dimensions can be increased, except as to the length of section, which is determined by the length of bar and by good practice. The galvanized corner bar soon assumes a dark blue color, and the concrete is colored to match, hence the bar is hardly noticeable. The curb, when finished, looks very much like machine dressed bluestone, with nicely rounded corner. The long, broad bearing of the section and great weight provides necessary stability. The records of the Department of City Works of Brooklyn Borough show that bluestone curb set in concrete costs from \$1.20 to \$1.35 per foot. Granite or medina would cost at least as much. The steel-bound Wainwright curb is quoted at 87 cents per lineal foot complete.

REINFORCED CONCRETE PAVEMENTS

Some Foundations Require Special Attention—Ordinary Specifications Inadequate—Work at Hattiesburg, Miss., a Decided Innovation

By R. C. HUSTON, M. W. S. E., City Engineer

THE day is fast approaching when the first cost will not take precedence of the other requirements of an ideal pavement; macadam is replacing granite blocks for comfort, asphalt is replacing macadam for cleanliness, and bitulithic, the old cedar block for sanitarness. The wearing surfaces are often selected by committees composed of business men, based on their investigations of existing pavements; but the character of the foundation is left to the engineer, and it becomes his duty to see that this, as well as the wearing surface, is of the best construction.

The foundation especially demands his attention, because this has not been made a specialty by paving contractors, as have many kinds of wearing surface, specifications for which he can obtain prepared by experienced engineers, under which contractors do not hesitate to guarantee work for periods of from five to ten years. The National Brick Manufacturers' Association, for instance, the Warren Bitulithic Company, and others, have prepared excellent specifications for their respective pavements, which should be adopted or carefully considered by City Engineers. But the local conditions may call for special requirements for foundations not met by ordinary specifications.

An illustration of this has occurred at Hattiesburg, Miss., where the soil is of a spongy clay, very hard to pick when dry, and when wet has a tendency to swell and settle. The accompanying figure shows a cross-section of Main street; also the underground work, consisting of sanitary sewer, storm sewer, water and gas mains, and telephone conduits. This street is very narrow and the traffic heavy. The Mississippi Central Railroad depot is at one end and the business center at the other. All these underground improvements are now being constructed with the exception of the sanitary sewer, and will be followed immediately with the pavement.

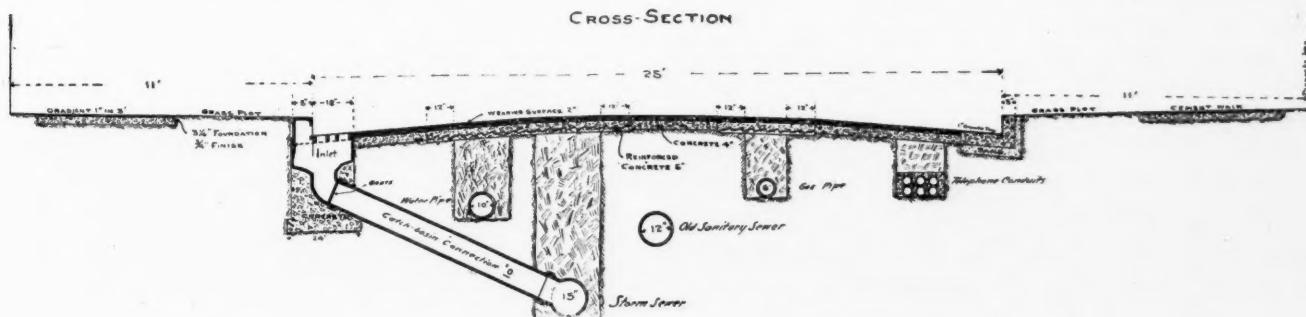
Owing to the nature of the excavation, great care is taken with the backfilling; all ditches are thoroughly tamped and puddled where the character of construction permits, but in order to take special precaution the foundation will be reinforced as shown in the illustration.

The following is an extract from the specifications governing reinforced concrete foundations:

"If, in the opinion of the City Engineer, it is deemed necessary to reinforce the concrete foundation over filled trenches, the contractor shall furnish and place under the direction of the City Engineer, expanded metal of not more than 3-inch mesh and No. 10 gauge steel. The cross-section area of same shall not be less than .185 sq. in. per one foot (1') in width. The contractor shall be paid for actual work completed at the schedule of price bid for."

The contract price for reinforced work, including 5-inch foundation composed of Portland cement, portions 1, 3, and 5, is 90 cents per sq. yd. The difference in cost as per contract between plain concrete 6 inches thick and reinforced concrete is 30 cents per sq. yd., or about 15 per cent. of the total cost of the completed pavement.

Reinforced concrete foundations are to be used on all refilled trenches under all classes of pavement throughout the city, which has recently closed contracts for about \$150,000 worth of brick and bitulithic pavement.



SHOWING REINFORCED CONCRETE OVER REFILLED TRENCHES

DEVELOPMENT OF THE FIRST STREET IN AMERICA



FIG. 1.—LEYDEN AND MAIN STREETS, PLYMOUTH, MASS., IN 1622

LEYDEN STREET, Plymouth, Mass., the first street in America, named after the famous Holland University city, from which the Pilgrims came, was surveyed on the 28th of December, 1621. The records state that "so many as could went to work on the hill, where we purposed to build our platform for our ordnance, and which doth command all the plain and the bay, and from whence we may see far into the sea, and might be easier impaled, having two rows of houses and a fair street. So in the afternoon we went to measure out the grounds; and first we took notice how many families there were, willing all single men that had no wives to join with some family, as they thought fit, so that we might build fewer houses; which was done, and we reduced them to nineteen families. To greater families we allotted larger plots: to every person half a pole in breadth and three in length, and so lots were cast where every man should lie; which was done and staked out," and this was laying out of Leyden street. An unfinished plan of this street is to be seen on the old records at the Court House.

The street was laid out in reference to the water supply, for "there is a very sweete brooke runnes under the hillside and many delicate springs of as good water as can be drunk." The above illustration is from a sketch by Isaac De Rasieres, a visitor from New Netherland, who gives this account of the architecture: "The

houses are constructed of hewn planks, with gardens also enclosed behind and at the sides with hewn planks, so that their houses and courtyards are arranged in very good order, with a stockade against sudden attack; and at the ends of the street are three wooden gates. In the center, on the cross streets, stands the Governor's house, before which is a square enclosure, upon which for pateriors [steen-stucken] are mounted, so as to flank along the streets. Upon the hill they have a large square house, with a flat roof, made of thick sawn planks, stayed with oak beams, upon the top of which they have six cannons, which shoot iron balls of four and five pounds and command the surrounding country."

Now Plymouth is a town of about 10,000 inhabitants. Main street, the principal business street, shown in the illustration below where it meets Leyden street, is now a well macadamized street with granite curbing and concrete sidewalks and substantial buildings on each side. The town is provided with a public water works, sewer system, gas, electric plant for light and power and an electric railway. Throughout most of its history notable as a fishing village, thriving manufactories now provide profitable occupations for the townspeople.

The photographs are through the courtesy of Mr. A. S. Burbank, Plymouth, Mass.



FIG. 2.—LEYDEN AND MAIN STREETS, PLYMOUTH, MASS., IN 1906

STREET PAVING IN THE UNITED STATES

Statistics and Reports—Data Collected by Department of Commerce and Labor—The Use of Macadam and Granite, Asphalt and Bitulithic—Cities and Population

THE following data are compiled from the statistics for the year 1903 as collected by the Department of Commerce and Labor. These are the latest from the entire country which have been tabulated and published.

Macadam, of course, was in use on more miles of street than any other paving in both 1900 and 1903; gravel was second in 1900, and asphalt third, while in 1903 these had exchanged places; stone block was fourth both years; brick and wood block alternated in the fifth and sixth places, while cobblestone occupied seventh place both years.

The present popularity of a street, however, is measured, not by the amount in existence, but by the amount being laid. Between 1900 and 1903 asphalt seemed to be the most popular paving, brick next, macadam third, gravel fourth (if gravel and macadam be classed together they would rank as third), stone block, cobblestone, and wood block following in order; but all those below macadam show a net loss. These figures are in many ways misleading, unless we realize just what they mean. Apparently a very small amount—80 to 90 miles—of macadam was laid. Actually it is probable that there should be added to this a very large part of the increase of mileage in asphalt and brick streets, because most of these replaced old macadam or other inferior pavements. Wood block shows a very considerable decrease, while it is certain that during those three years some new wood block paving was laid, and the loss shown is the net loss. It is unfortunate that no distinction was made between the old style cedar blocks (of which Chicago alone removed 84 miles during those three years) and the new style of creosoted block.

It is gratifying to see that the mileage of unpaved streets decreased from 140 per cent. of that of the paved streets in 1900 to 130.5 per cent. of the same in 1903.

The asphalt pavements existing in 1903 probably had cost for construction more than \$100,000,000; the brick more than \$60,000,000; and the macadam more than \$80,000,000. In the year 1902-3, the cities of more than 25,000 population spent \$5,228,185 for paving of roadways, together with a probably large percentage of \$7,084,101 reported as "general street expenses." The total expenditure for construction and maintenance, including cleaning, was about \$33,000,000, or nearly one-fifth of the total outlay of these cities.

Work done in cities of less than 25,000 is not tabulated here. It is well known that in the last few years the paving business has developed to a remarkable extent in small towns. Brick and asphalt block pavement, as well as macadam, have been extensively laid in enterprising places of five or ten thousand population, while the increased use of portable paving plants has brought sheet pavements within the reach of any town that wishes to lay a few thousand yards on its principal business street. Moreover, permanent pavements have been laid on county roads in the vicinity of large cities, as in Cuyahoga county, Cleveland, Ohio. On county roads, of course, macadam is the ordinary material used in improvements, and in some States it is laid under specifications insuring as high-class work as is done in cities of the size included in the table.

CITIES HAVING POPULATIONS OF	MILES OF STREETS PAVED WITH								Total Paved	Un- paved
	Cobble Stone	Granite and Bel- gian Block	Brick	Wooden Block	Asphalt and Asphalt Block	Ma- cadam	Gravel	All Other Material		
More than 1,000,000.....	228.2	838.5	229.3	666.1	990.9	1,507.5	18.6	26.4	4,505.5	3,977.6
From 500,000 to 1,000,000.....	373.6	276.9	94.8	4.3	69.5	598.8	57.5	101.0	1,576.4	474.8
From 300,000 to 500,000.....	320.1	389.2	235.1	276.7	579.6	260.5	342.8	86.5	2,490.5	2,418.8
From 100,000 to 300,000.....	65.7	454.6	407.9	92.5	735.8	761.3	553.4	25.4	3,096.6	5,568.9
From 50,000 to 100,000.....	175.7	290.5	298.7	46.9	274.3	1,136.2	496.6	122.3	2,841.2	3,246.2
From 25,000 to 50,000.....	29.8	113.9	478.4	128.6	195.5	1,292.4	1,111.1	95.4	3,445.1	7,750.1
TOTAL.....	1,193.1	2,363.6	1,744.2	1,215.1	2,845.6	5,556.7	2,580.0	457.0	17,955.3	23,436.4
Percentage of all paved streets.....	6.6	13.2	9.7	6.8	15.8	30.9	14.4	2.6	100.0	130.5
Ditto in 1900.....	6.9	13.4	7.8	8.8	13.6	30.5	14.6	4.4	100.0	140.1
Order according to total lengths, 1903.....	7	4	5	6	2	1	3			
Order according to total lengths, 1900.....	7	4	6	5	3	1	2			
Order according to net increase in length.....	6	5	2	7	1	3	4			

STREET DESIGNING

General Principles Involved—Cross Section and Details—Width of Roadway and Sidewalk—Gutters and the Requirements of Railways—Economy a Consideration

By A. PRESCOTT FOLWELL

General Principles—Health, Convenience, Comfort, Pleasure, and Economy should be considered in every municipal structure or service, generally in the order given, although pleasure and comfort may properly outweigh convenience in residence and certain other districts.

Health calls for fresh air and abundant light, which are excluded from narrow streets and alleys, from short blind streets, and by frequent sharp turns; also from "back tenements" in the interiors of blocks, which generally result from planning these larger than the character of the district warrants. Light is more uniformly and generally distributed where the streets do not run due east and west. Dry soil is necessary, and to secure this it may be best to locate streets in drainage channels from low spots, or even to create such a drainage street from a natural basin, and to raise low ground by filling in. Healthful recreation is furnished by parks and playgrounds.

Convenience demands that the greatest possible number of citizens be given facilities for reaching quickly points where business or inclination calls them, and with the least effort.

Comfort is given by shaded trees on easy grades; by clean, dry roadways and sidewalks; by latrines or public-comfort stations; by seats in parks and at waiting stations for cars, cabs, etc.; by street lights; and in numberless details of street construction and appurtenances, and of their maintenance.

Pleasure, as well as health, calls for the providing of parks and playgrounds, public baths, recreation piers, and other forms of public diversion. Also the satisfying and training of the aesthetic tastes of the people by artistic parks, monuments, arches, etc., by avoiding a stiff and wearily monotonous street system; and by the prevention of anything offensive to sight, hearing, or smell.

Economy requires a consideration of how the above may be secured with the least annual cost of interest, sinking fund, and maintenance, bearing also in mind the possible limitations of the city's financial condition.

The requirements of proper designing are: Consideration of the location and alignment of the streets individually and in relation to each other; their grades; the width of roadway and sidewalk; sizes of blocks; locations of parks, cemeteries, and public buildings; the treatment of streams and water fronts; and numberless other details.

The purposes of streets are: To act as thoroughfares for passing from one place to another distant one; as means of access to the buildings and grounds facing upon them; and as open spaces to admit light and air to the adjacent buildings.

THE STREET CROSS-SECTION

A business street will ordinarily consist of not more

than three classes of ways—roadway, railway, and sidewalk. Sidewalks are placed next to the buildings because only pedestrians require direct entrance to these. Railway tracks are almost universally placed in the center of the roadway; among other reasons, because carriages need to stand next to the sidewalks, and because the street has here its greatest side-slope, while railway tracks should be level transversely. If there are trees in a business street, they will occupy small detached areas only, and not continuous sodded strips, that there may be as little interference as possible with passing between sidewalk paving and street.

Transverse grades are undesirable on either sidewalk or roadway, except such as are necessary to shed water. If these grades are too steep, pedestrians, horses, and vehicles all find difficulty in using them, especially when they are icy, and riding over them is uncomfortable. The transverse grades should therefore be kept at a minimum.

Sidewalks slope away from the adjacent buildings to carry surface water away from their foundations. In New York this slope is by ordinance one inch in five feet. In Pittsburg, Pa., one inch in four feet for concrete and flagstone sidewalks; one inch in two feet for brick. One inch in five feet is probably the flattest, and one inch in two feet the steepest slope which any sidewalk paving should have.

Roadways in modern streets slope toward the sidewalks; in ancient streets and in many alleys, toward the center. Objections to the center gutter are, the greater amount of excavation required to grade the street even lower in the center than at the curb, and the inconvenience of driving in a gutter. (In alleys where there are no sidewalks or curbs, however, the gutter will generally be in the center.) It is necessary, if the sidewalk is to be kept dry, that it be raised above the gutter; and this is desirable in order to prevent vehicles from encroaching upon it also. The side of the gutter may be given a slope more or less flat, or may be practically vertical—a curb. In general, gutters on opposite sides of a street should be of equal elevations, that the roadway cross-section may be symmetrical, although on hillsides this may be impracticable.

The crown, or required rise of the center of the roadway above the gutter, is given as follows in Byrne's "Highway Construction":

Kind of Surface	Ratio of Rise to Width of Roadway	Kind of Surface	Ratio of Rise to Width of Roadway
Earth	1-40	Brick	1-80
Gravel	1-50	Asphalt	1-80
Broken stone	1-60	Wood	1-100
Stone blocks.....	1-80		

Andrew Rosewater would vary the crown with the grade of the street. His rule is as follows: For asphalt, $c = \frac{W(100-4f)}{5,000}$. For brick, stone, wood, and macadam, $c = \frac{W(100-4f)}{6,000}$, in which c is the crown of the pavement in feet, W is the distance between curbs in feet, and f is the fall per 100 feet of street. This seems to the author to give too much crown for asphalt and brick and not sufficient for macadam.

James Owen considers 1-160 as sufficient crown for asphalt and brick. In New York asphalt streets crown 1-100 of the distance between curbs; in Wabash, Ind., 15-1000; in Champaign, Ill., 14-1000 + 0.03 feet; in Indianapolis, from 12-1000 to 15-1000. The crown should in general be the flattest which will drain surface water to the gutters. Probably Byrne's table, with asphalt changed to 1-100, is as good as any.

The form of crown may be theoretically a section of a circle, ellipse, or parabola, or two straight lines joined by a circular arc. It makes little difference which of the first three is adopted, since with a crown of only 1-80 to 1-100 it would be difficult in practice to make the variation between the theoretical and actual less than the slight differences of these three among themselves. The parabolic form is obtained by dividing the roadway width into, say, 20 equal parts, and using vertical ordinates as follows:

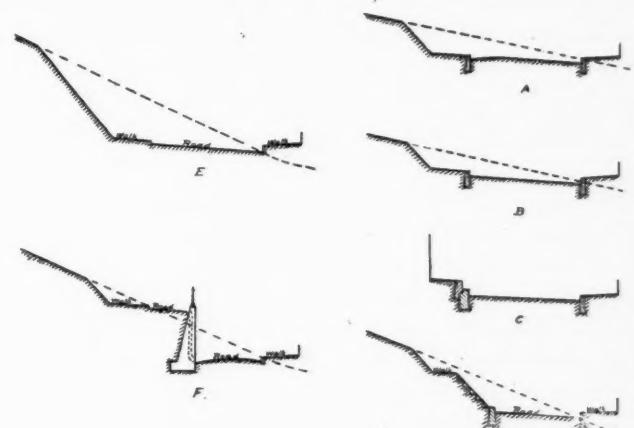
Distance from curb Form of cross-section	0	1-20	2-20	3-20	4-20	5-20	6-20	7-20	8-20	9-20	10-20	Ratio between ordinate and total crown
Parabola...	.00	.19	.36	.51	.64	.75	.84	.91	.96	.99	1.00	
Straight lines joined by circular arc.	.00	.12	.24	.36	.48	.60	.72	.84	.96	.99	1.00	

The chief objection to the straight line is that wheels and hoofs will wear it concave in time, in which condition proper drainage will not take place.

Gutters should be of a depth sufficient to prevent surface water from rising onto the sidewalks. This depth will depend upon the length of street which drains to a given gutter and the grade of the gutter. Where there are sewers with surface-water inlets not more than 200 feet apart, 4 inches is ordinarily sufficient. In New York, gutters are ordinarily 3½ to 4½ inches deep. From 5 to 7 inches is more common, however. Above 8 inches is undesirable. Probably 6 inches is the most common depth.

Gutters are sometimes made level transversely, but a more common practice is to give the gutter the same slope as the roadway. The curb which forms the side of the gutter should rise even with the sidewalk paving where this extends to the curb. If there is sod between sidewalk and gutter the curb should be sufficiently lower than the sidewalk paving to allow a slope of not less than 1 inch in 2 feet between them; double this slope would be better. The depth of gutter should be uniform throughout any one block—throughout the street, if possible. (An exception is made when the curb is level and the gutter is given a slope both ways from the middle of the block to afford drainage.)

On side hills it is sometimes necessary that one sidewalk be considerably lower than the other, and that one gutter also be lower than the other. The crown may then be retained at the center of the roadway, and the slope to the lower gutter be made the steepest desirable, that to the upper coming as it may. But a better plan is to give a slope from both gutters within the limits of the slopes allowable for such pavements, letting the crown come at the intersection of these slopes (Fig. A). This may result in a continuous slope from one gutter to the other (Fig. B). Such slope should never exceed 1-40 for asphalt, nor 1-30 for any pavement. The down-hill curb on such a street should be, if anything, higher than on level streets, since that gutter must receive water from the whole street. Since the lower sidewalk must be as high as the curb this may lead to such a depression of the roadway that the upper sidewalk will be some distance above its curb, or else that it will be considerably below the natural surface. The latter method, making the curb face not more than 6 or 7 inches deep, is advisable for business streets (Fig. B and E). A modification for such streets was adopted in Wabash, Ind., where a step was placed between the sidewalk and the



CROSS SECTIONS OF SIDE-HILL STREETS

roadway, having 10-inch rise and 12-inch tread, an upper and a lower curb forming the risers (Fig. C). In residential streets the sidewalk may be several feet above the curb, a lawn sloping from sidewalk paving to curb (slope 2:1 to 1½:1), in which are set steps opposite such residences as desire them (Fig. D). Such a sidewalk may descend by steps at each cross-street to the level of that street, but it is better to slope it down to the curb level at such crossings. Some streets on very steep hill-sides have been divided into two levels, the upper street being held by a retaining wall (Fig. F). If this construction is continued for more than one block, the cross-street may be discontinuous in grade, the lower stretch connecting with the lower roadway, the upper stretch with the upper. If the grade is continuous, the roadways of the divided street must slope to the level of the cross-street at each intersection, or bridges must be placed over one street or the other.

Street railways generally require special methods of drainage, since the water falling between the rails can

not reach the gutters opposite, nor can that between double tracks. The space between tracks should generally be crowned; that between rails has been made crowned, dished, and level, each having its disadvantages. Asphalt should probably be crowned to keep it as dry as possible, although this encourages the entrance of water between rail and paving, which is objectionable; but it is for several reasons inadvisable to use asphalt between rails at all. Sandstone blocks, granite blocks, brick, wood, or even cobble, may be preferable in these positions.

WIDTHS OF STREETS

The functions of streets, as previously stated, are three-fold: To act as thoroughfares; as means of access to property fronting on them; and as open spaces for admission of light and air to buildings. The first-named function does not apply to strictly residence streets, but the others apply to all. Thoroughfares require a width sufficient to allow to pass through them without danger all the numbers and characters of vehicles for which this is the natural route, together with all the foot-passengers desiring to do so; at the same time allowing room for vehicles to stand at the allotted places, and for pedestrians to stand close to the show windows. Side streets should fill the same requirements, but the numbers to be provided for are very much less. These two functions apply to the street surface only. To admit light and air the width between buildings from ground to roof must be sufficient. Another function is assigned to modern streets—to contain beneath their surfaces pipes, wires, conduits, and numberless other contrivances both public and private, and to carry the same above their surfaces also. The first three are the proper functions of streets and in no way interfere with the other; the last named is improperly imposed, and interferes with each of the three proper functions. A separate space should be assigned for these, either interposed longitudinally in the street, or placed entirely without its limits.

As a passageway for vehicles the street is limited between curbs; for pedestrians it is limited between curb and property or fence lines; for admission of light and air its width extends between buildings at their roofs, which may be greater than that between building lines.

Sidewalks are intended for pedestrians only, for whose safety and convenience all other modes of locomotion are forbidden thereon. To insure against encroachment of vehicles and of drainage water, curbs are placed between the sidewalk and roadway.

The width of sidewalks should be sufficient between curb and building line to permit the greatest ordinary number of pedestrians to pass going in opposite directions without undue crowding. On a side street, where there is almost no travel, 5 feet is sufficient, as this permits two persons to pass each other or to walk abreast. For a street of secondary radiation there should be room for four people abreast, or about 10 feet. For retail business the width should be from 15 to 30 feet, depending upon the size of the city. The above dimensions refer to available passageway, properly paved. The New York rule for distance between curb and building line is:

Width of street.....	40	50	60	70	80	80 to 100	Over 100
Width of sidewalk.....	10	13	15	18	19	20	22
Width of roadway.....	20	24	30	34	42	43 to 60	Over 60

There are, however, many exceptions to this rule.

The accompanying table, column —, gives, for ordinary residential streets, sidewalks of 4 to 22 feet, the average being 6 feet. Probably those above 10 feet in this table refer to the distance between curb and building line, and most of those under 10 feet to the paved passageway only, since column 11 gives 27 feet as the average distance from curb to residence, and a comparison of columns 1 and 13 would give 19 feet as the sidewalk width.

In certain cases both sidewalk and available passageway may be narrow, or even omitted altogether; as in front of warehouses, wholesale storehouses, and the like, when these occupy all of a considerable stretch of street which is not used as a thoroughfare, but chiefly to give access to the buildings for heavy carts and drays; also between the roadway and railroad yards, wharves, and other freight depots.

The width between curb and building line should be the greatest which will probably be required by the streets for many years to come, since the cost of moving the building lines away from the curb after the city is built up will be enormous. The paved walk, however, need be no wider at any given time than necessary to meet the demands of that time. For side streets 10 to 15 feet will probably be ample; for purely residence thoroughfares the same; for residence streets not main thoroughfares 5 to 10 feet is customary; for business thoroughfares 20 to 35 feet should be allowed; for business side streets in the heart of the retail district 20 to 25 feet, but for those which are merely spurs from the main business streets, and for streets in the wholesale district, 15 to 20 feet will generally be ample.

The width of roadway should be sufficient to accommodate all vehicles for many years to come, so far as the demand can be foreseen. Where large numbers of any special kind of vehicle are expected to frequent a given street, separate ways should be provided for them, since different kinds of traffic interfere with each other, causing both annoyance and danger. It is desirable to have one way for heavy and slowly-moving vehicles—coal wagons, freight drays, etc., and another for rapid delivery wagons, carriages, and the like; still others for bicycles and automobiles; another for street railways (where such are allowed by the citizens to use the street surface); another for speeding horses; another for saddle horses. Probably no one street will need to provide for all these, and only main thoroughfares will ordinarily be subdivided; the small numbers of each class of vehicles which will use the side streets making it easy for them to avoid interference. Occasional cross-streets should be treated as thoroughfares for cross travel, however, these being made more and more frequent as the business center is approached, every street there being so treated.

A roadway in a business thoroughfare, without car tracks, should have room for a wagon to stand along each curb, a line of wagons to move in each direction inside of

these, and space between these for the more rapid vehicles to pass the slower, or about 40 feet. This is the least which will give tolerable satisfaction. It is extremely desirable to add 15 feet to this, thus allowing separate ways for fast and slow vehicles. A single car track should be allowed 10 feet additional, a double track 20 feet, except where the cars are infrequent, when this space can be utilized for the turning out of vehicles, and the above be reduced by about 8 feet. This gives for a thoroughfare with single much-used track 65 feet of roadway, with double track 75 feet; with infrequently-used track, single 57 feet, double 67 feet; without special ways for slow and fast teams and with much-used tracks, single 50 feet, double 60 feet; the same with infrequently-used tracks, 42 and 52 feet respectively. Many business streets in large cities have less than these widths, but the traffic suffers thereby.

In residence thoroughfares 40 feet with a single track, 50 feet with a double is generally sufficient, and 30 to 35 feet if there be no track. It is safest to assume, however, that every thoroughfare may some time contain one track at least; although the actual roadway may not be made originally of corresponding width, but additional space be reserved for expansion when a track shall be built. (Such expansion being made at the expense of the railway company?)

In business side streets the widths given for residence thoroughfares will generally be ample. In residence side streets 22 to 30 feet of roadway is generally sufficient. Forty feet should be reserved for this purpose, however, to allow for possible car tracks or unforeseen changes in the character of the street. (In Toronto 24 feet, in Albany 24 to 30 feet, are considered ample for residence streets. A coal cart backed up to the curb occupies about 14 feet. A moving team requires about 8 feet.) The table gives the widths between curbs on residential streets as between 24 and 60 feet, the average being 39 feet, and about half the cities reporting 30 feet. The tendency of late years has been to make the roadways of side streets narrower than formerly, one great advantage of this being the reduced cost of roadway paving and maintenance.

Alleys may be sufficiently wide for foot passage only, but these are not recommended. They may be wide enough for one team only, or for two teams to pass. The table gives the widths of alleys as from 14 to 35 feet, with an average of 19 feet. There should be no sidewalks in an alley, nor anything to encourage the building of any structures but stables facing thereon. Sixteen to 20 feet is therefore suggested as ample width for alleys, permitting the necessary teams to pass through, but discouraging others.

MUNICIPAL ASPHALT PLANTS

Success Attained in Many Cities Where They Have Been Established—Cost in Allegheny, Pa.—Reasons for High Bids

THE engineering and highway departments of all important American cities are wrestling with paving problems which are, perhaps, as complicated and difficult as any matter connected with municipal government. One of the recent important developments has been the establishment in many cities of asphalt paving and repair plants, owned and operated by the municipalities. Various reports of the operation of such plants, made from time to time by local officials, point to uniform success and a considerable saving to the cities using them.

Whatever opinions may be held as to the general principle of municipal ownership, there are important reasons for believing that the operation of such plants offers a wise solution of a difficult matter. Among the cities already equipped in this way are Winnipeg, Detroit, Allegheny, Pittsburg, Montreal, New Orleans, and Kansas City.

The Borough of Brooklyn has decided to establish such a plant; Newark, N. J., has a limited equipment, and some other cities have the matter under consideration. Asphalt paving in the past has been excessively expensive in many cases. Until recently there was a monopoly of material. The establishment of a paving equipment involved a large outlay, and the rule was for contracting companies to have their paving bids cover a large part of the cost of their equipment. Aside from this, in competing for contracts, the companies expended money very liberally in entertaining city officials, with a view to winning their good-will, and the expenditure of money in other ways, which in the end fell upon the taxpayers.

At the present time, paving asphalt of the highest quality is selling at lower prices than ever before. The art of laying good pavements is more clearly understood. From 85 to 90 per cent. of all sheet asphalt pavements is stone and sand, very inexpensive materials and easily obtainable at all points.

With the municipal ownership and operation of a street paving and repair plant, asphalt pavements can be laid and maintained in good repair by any and every city at a lower cost by far than any other modern pavement.

The Allegheny, Pa., Highway Department has found that the cost of paving and repair work has been about 75 cents per yard. Recent contracts in the Borough of Brooklyn and vicinity indicate that the sheet asphalt pavements of reliable quality can be laid at about this price, not, however, including the concrete base.

It seems certain that the establishment of municipal asphalt paving plants, in charge of experienced paving men, is a wise solution of the maintenance of existing pavements which have been laid at great cost, and also for the improvement of streets hitherto unpaved.

TARRED MACADAM IN NEW JERSEY

**Successfully Used at Montclair—Streets Free from Dust—
Experiments on Steep Grades—Process and
Results Described**

By MALCOLM H. SMITH
Superintendent of Roads, Montclair, N. J.

WHILE macadam roads of trap rock have given excellent satisfaction in New Jersey, the disintegration due to frost, storm, and drying out in the sun, and the dust nuisance, which has been greatly increased by the growing popularity of the automobile, have demanded improved methods of maintenance.

In the attempts which have been made towards overcoming these difficulties, more attention has been given to the dust problem than to the question of disintegration, and many preparations to abate the nuisance have been tried with varying success. Crude petroleum oil has perhaps been used most extensively, and with valuable results in laying the dust; but the unpleasant odor, and the danger of injury to varnished vehicles or clothing from particles thrown by the wheels, are serious objections to its use.

In the Town of Montclair, New Jersey, coal tar, known as Tarvia, has been used on Telford and Macadam roads with the result that it not only does away with the dust nuisance, but also preserves the surface of the road. The experiments have been made, so far, on streets of steep grade, which were continually breaking up from the effect of sun and storms. In September, 1904, about one thousand feet of Telford road were treated with coal tar by the following method: The street, which had a grade of five to seven per cent., and which was in fair condition, was swept clean, and the tar was spread over the surface thickly by means of sprinkling pots with holes about one-tenth of an inch in diameter. On this was spread stone dust, sifted through a screen with half-inch meshes, and the road was well rolled down with a ten-ton steam roller. The second coat of tar was then put on and covered with stone sifted through a sand screen; the surface was again rolled, putting on more of the smaller stone, until the whole road was smooth and compact, with no tar coming to the top. The result of this treatment has been most satisfactory. After nearly two years' wear the street is still in good order, the surface has not been broken up, and it has been free from dust all the time.

STREETS FREE FROM DUST

In the case just described, a street which had been in use for some time was merely resurfaced with the tar. During 1905, other stone roads were made, using tar as a binder instead of clay. Inch-and-a-half stone was spread to a thickness of three to five inches, then covered with three-quarter inch stone, well rolled down. This was coated with tar and three-quarter and half-inch stone and rolled to a compact, smooth surface. These streets have



UNION STREET, MONTCLAIR, N. J.
(Treated with "Tarvia")

also been free from dust, and the surface shows no evidence of wear, although they have had considerable heavy traffic.

The process by which these results have been obtained is a simple one, requiring for equipment only a kettle or tank for heating the tar and sprinklers for spreading it. Care should be used not to overheat the tar, and to strain it into the sprinkling pots. In resurfacing, as in the first instance described above, the results are more valuable if the tarring is done on a good road-bed. About six or eight barrels are required to treat the surface of one thousand square yards of roadway.

It is evident from these experiments in Montclair, that tar may be successfully used as a cementing medium in road making; that it produces an impervious surface, free from dust and mud; that it also imparts to the road the elasticity of an asphalt pavement, while the macadamized surface gives a better foothold. The absence of dust removes the necessity for sprinkling, and this goes far toward meeting the extra expense entailed in the tar construction.



CLAIRMONT AVENUE, MONTCLAIR, N. J.
(Treated with "Tarvia")

VITRIFIED PAVING BRICK

Merits of Material and Results Attained—An Economical Pavement—The Problem of Wear and Tear —Other Features

By W. P. BLAIR

President of the National Paving Brick Manufacturers' Association

VITRIFIED paving brick are known to engineers and contractors familiar with their use, by certain designation, conveying to the mind a meaning which, if described fully in detail, would require many words. Even the word *vitrified* has a meaning of its own when applied to brick. It means being brought to or approaching a molten state—sufficient to thoroughly fuse.

For the most part they are classed as follows: For instance, "No. 1 repressed block"; "No. 1" relating to quality; "repressed" relating to the method of manufacture, and "block" indicating the larger size, 3 1/4x4x9 inches—more or less; "No. 1 standard block," the same as No. 1 repressed block, except that the word "standard" means that in the method of manufacture the brick or block are not *repressed*, but simply *wire cut*. The smaller size are called brick instead of block and are designated in like manner. Thus, "No. 1 repressed brick," and so on.

In the matter of grading, "No. 1" are classed by the manufacturers by substantially the following rule: They must be thoroughly vitrified throughout, free from fire, center or air checks must show one fairly straight edge, slight kiln marks allowed on best edge, more pronounced kiln marks allowed on the opposite edge; under-burned, over-burned, and warped brick to be carefully excluded from this grade. As a matter of fact, such quality of brick will withstand a cross breaking strain, showing greater strength than most granite. The quality then of both toughness and hardness is apparent.

PROBLEM OF WEAR AND TEAR

With such material furnished, it remains only to place them in position as a wearing surface, giving them the greatest possible advantage against abuse, as the edges of the brick will chip off little by little, unless protected in some manner against the impact that comes from daily use and from all directions, oftentimes with remarkable force. It is easy to be seen that, if the wear can be confined to a friction or an even wear, by such wear an even surface will be constantly maintained. This gives an ideal street which will for years grow slightly better than otherwise. From years of experience in building and using streets, all theoretical conclusions have been demonstrated in fact, and every detail of construction which has proven in every way correct has been reduced to a concise direction for laying brick street pavements through the efforts of the National Paving Brick Manufacturers' Association.

What are the chief points in these directions that they should be urged? We would say:

First,—it makes traction easy and comfort of travel almost perfect. The cushion along the curb provides room for expansion and allows the pavement to lie in the

closest contact with the two-inch sand cushion; hence, the noise is reduced to a minimum. Filling the joints with cement and sand mixture compels the wear to be an even one and, with sufficient traffic, the pavement after a few years' wear becomes entirely smooth. These requirements, also, make the sanitary effect as perfect as can be—no possible contamination of the soil about or underneath.

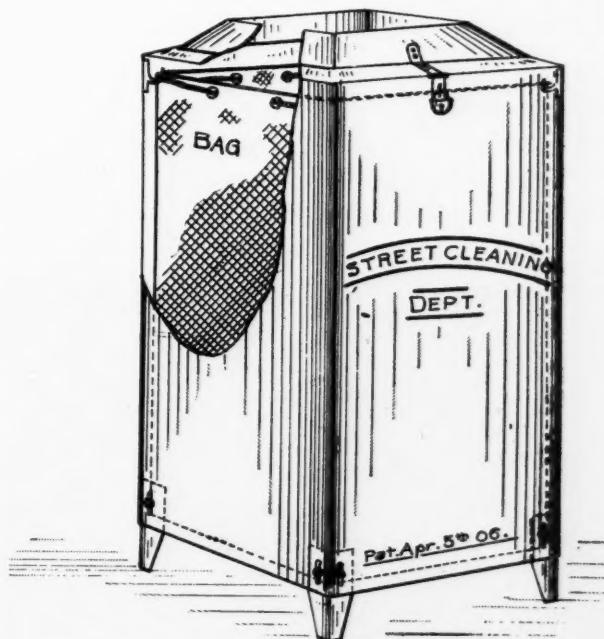
This construction, too, is economical for the reason that it makes the pavement durable. No such constructed pavement anywhere has ever yet needed repairs. The possibilities of brick pavements at their best put brick as a paving material into a class by itself. It combines all the requirements.

MODERN STREET CLEANING

Denver's Experience with the Sanitary Rubbish Can—At First a Convenience, Now a Necessity—Is Cleanly and Effective

By J. R. MOLER, Deputy Commissioner, Denver Supply Department

EXPERIENCE and observation have shown that the problem which has caused most discussion in civic societies has been that relating to the most sanitary and efficient manner of gathering the rubbish of the streets—the newspapers, letters, and scraps that citizens, for want of better means of disposition, have been in the habit of throwing into the gutters. These off-throwings have been of small importance in relation to the individual citizen, but of great matter when considered in relation to all the people of a city. For all large wholes are made of small parts. The stuff cast away by one man has been hardly worth the notice, but that thrown to the walks by all a cityful has created a situation that has been a public dilemma. Many years ago civic societies began to urge the use of cans on street corners for the gathering of this rubbish,



A SANITARY RUBBISH CAN—CONSTRUCTION SHOWN

with city wagons to visit them at frequent intervals to carry away what was deposited therein.

Many reasons present themselves to officers of cities why this rubbish should be cared for. Among them are the appearances of the streets, comfort during windy days, and the safety of buildings. A city with littered streets does not appeal to visitors; when the day is windy flying whirlwinds of paper make travel uncomfortable and even dangerous; piles of refuse in the alleys and vacant lots are a menace to property, as a carelessly disposed cigar may set the whole ablaze.

To meet this emergency the sanitary rubbish can has been made and patented. As a result of this trial it is now the official can of the city, used on all the public streets to the exclusion of any other manner of gathering rubbish. It has been found to be sanitary, effective, cleanly, and to allow a rapid and sure gathering of all rubbish of the city. Within a short time after they were placed on the corners, to replace the old, battered, unsteady, insanitary and awkward contrivances, it was noticed that citizens no longer threw away paper wrappings, envelopes, notes, torn scraps of paper, banana peels, orange skins, cores of apples and the other rubbish peculiar to a city. Instead they held it in hand until the next can was reached, when they cast it all into that receptacle.

DENVER AND STREET CLEANING

The records of the Street Cleaning Department of Denver show that the first attempt at having the rubbish thrown into cans stationed along the streets was successful, as it caused much of the natural off-throwings to be gathered and carted away, but the appearance of the sanitary rubbish can at once doubled and trebled the amount of the stuff carried away and dumped. What was at first but a convenience to the public, to the city and to the owner of property, has become a necessity. It saves appearances, adds to comfort and is destined to make insurance companies look upon risks in a much more lenient manner.

The can itself is a very simple affair. It stands 36 inches high, with sides of 19 inches each. The height makes it easy for foot passengers to drop in their waste as they pass. Adjustable feet are under each corner, so the can which is designed to be attached to a street post



RUBBISH LOADED ON WAGONS—DENVER STREET CLEANING DEPARTMENT

may be permitted to adjust itself to the pitch of that post or to the slant of the walk; thus, it may be kept always in a primly upright position. Within the can is a large sack, fastened to hooks within the top, but swinging clear of the walk. This sack is hung on hooks directly under the removable top, so arranged that when the top is down and locked the sack cannot be removed. The movable top is really a hopper through which the waste passes to the receptacle sack within. The sack can be removed only when the hopper top is unlocked and put to one side. This is to prevent any but those authorized from removing the sacks or any considerable part of the contents. Of course, as the hopper is kept open to facilitate the depositing of rubbish, it is within the possibilities that the spurious may inspect the contents, or a part of them. The sanitary idea is carried out by having perforations in the bottom of the sack to permit the escape of moisture, and this, together with the arrangement for the free circulation of air through the can, which has an open bottom, keeps the contents as near dry as possible.

An objection urged that the waste being very inflammable, danger would be incurred because of the throwing of cigars and cigarette stubs in among the rubbish, has not been upheld by experience. But once has this happened in Denver, where the cans have been on trial. And even then the presence of the can was an added safety, for it kept the fire within bounds, so that no damage resulted to anything but the contents of the can and the pouch.

A great point in favor of the sanitary can lies in the removal of its contents. The top is taken off, the sack or pouch lifted from the hooks supporting it, the drawstring at the top pulled, closing the mouth, the whole is thrown upon the wagon which is to bear the rubbish away to dumping grounds outside of the city and replaced by an empty sack. There is no possibility that the contents may be blown about the streets, thus undoing the work of the can, and the man in charge of the wagon may do his work in a trim uniform, or even in a dress suit. The can permits everything to be done in so cleanly a manner that the arrival of the dust wagon is not a signal for store-keepers to close their doors, in fear of a gust carrying dirt and desolation to its interior.



DENVER STREET CLEANING—A SANITARY RUBBISH CAN

WASHINGTON AND STREET PAVING

Asphalt Popular at National Capital—Results of Varied Experience—Few Unpaved Streets—Average Cost and Statistics—Population and Peculiar Conditions—A Municipal Laboratory

By S. WHINERY, M.Am.Soc.C.E., Etc.

WASHINGTON, the Capital of the United States, is doubtless the best governed city of any considerable size on the American Continent. This statement applies particularly to the construction and management of its public works and utilities. The results of experience with street pavements in that city, are therefore, of great interest to the municipal engineer, though they must be studied in the light of the rather exceptional character of the population and business of the city, which will be referred to later.

The population of the city proper, excluding the other portions of the District of Columbia, was, according to the census of 1900, about 218,000. It had probably increased by 1905 to at least 235,000. The whole of the District of Columbia is, however, now incorporated with the city under one government, with a total population in 1900 of 278,718, and the more recent municipal reports include the statistics of the whole District.

The last report of the operations of the Engineer Department of the District, for the year ending June 30th, 1905, contains a large quantity of interesting matter relating to the pavements of the District, a review of which may be of interest to the readers of THE MUNICIPAL JOURNAL. According to this report, the streets of the city proper (as it existed before the consolidation), are paved as follows:

Kind of Pavement	Square yards	Miles	Per cent. of whole area of streets, square yards	Per cent. of paved streets, square yards
Asphalt and bituminous sheet pavements.....	2,315,187	111.48	52.6	63.4
Asphalt block pavements.....	470,042	21.42	10.7	12.8
Vitrified block brick pavements..	21,635	0.88	0.5	0.6
Granite block pavements.....	401,122	21.02	9.1	11.0
Cobblestone pavements.....	204,926	8.68	4.7	5.7
Macadam pavements.....	236,339	13.70	5.4	6.5
Gravel and unimproved roads....	748,494	42.22	17.0	
	<hr/> 4,397,745	<hr/> 219.40	<hr/> 100	<hr/> 100

The two most noticeable facts disclosed by this tabular statement are, first, the very small percentage of the streets of the city that are unpaved, and, second, the very large percentage of the improved streets that are paved with asphalt. It appears that over 63 per cent. of the pavement is sheet asphalt or other bituminous surfaces, and if we include the area paved with asphalt block, over 76 per cent. of the whole paved area is covered by sheet and block bituminous pavement. The preference for these two kinds of pavement by the District government is shown by a quotation from the report. The Commissioners of the District, in whom the municipal government is directly reposed, say:

"These two classes of pavements are practically the only types of modern pavements which are used in the District of Columbia. There is a small amount of vitrified brick pavement laid, but being noisier than either the asphalt or the asphalt block pavement, the latter is preferred. Gutters on sheet asphalt pavements are laid of vitrified brick, as it has been found that the fluids which reach the gutter are apt to rot the asphalt pavements, but not to affect the brick. While some granite block pavements still exist in the business portion of the city, it is the belief of the Commissioners that they should be removed and replaced by asphalt pavement. It has been the policy of the Commissioners to do this in former years, but the practice was abandoned by direction of Congress."

AVERAGE COST SMALL

The experience of the city seems fully to justify the preference shown for asphalt pavements. Aside from the now well understood and admitted superior qualities of the pavement from the standpoint of aesthetics, sanitation, and comfort in use, the pavements in Washington have not only been secured at a very low first cost, but the cost of maintenance has been remarkably low. In some of the former annual reports a statement of the cost of maintenance of the asphalt pavements of different ages was given, but this does not appear in the present report. There is, however, a table of the paved streets of the city, giving the year when each pavement was laid, its area, and (for the asphalt pavements) the average cost of repairs per square yard per year since the expiration of the five-year contractors' guaranty.

From this table the writer has taken out the data for the sheet asphalt pavements laid in the year 1890 and those laid in 1893. The former were fifteen, and the latter twelve years old at the date of the report. In 1890 it appears that the area of sheet asphalt pavement laid, and for which the cost of maintenance is given, was, in round numbers, 137,000 square yards, and the cost of maintenance for this whole area has averaged, for the ten years following the expiration of the contractors' guaranty, about 1.1 cents per square yard per year. The above quantity and cost of maintenance do not include a part (some 45,000 square yards) of Pennsylvania avenue pavement, which appears to have been laid in 1890, about which the record as to resurfacing and maintenance does not seem to be clear. The quantity of sheet asphalt pavement laid in 1893, and therefore twelve years old, was comparatively small, about 38,400 square yards; and the cost of maintenance for the seven years following the contractors' guaranty has been only about one-fourth of one cent per square yard per year.

It is hardly possible from the data given to fairly de-

duce the cost of maintenance of the pavements that are much older than fifteen years. Quite a number of such pavements have been resurfaced, and those resurfaced were doubtless the ones upon which the cost of repairs for the last few years of their lives had been heaviest. But it is worth noting that there are about 800,000 square yards of asphalt pavement still in use that is over eighteen years old.

WASHINGTON A RESIDENCE CITY

In discussing this remarkable record, it is necessary to bear in mind some conditions prevailing in Washington which exist in few other cities, and which greatly influence the life and the cost of maintenance of asphalt pavements:

1.—Washington is pre-eminently a residence, rather than a commercial or manufacturing city. The travel to which the pavements are subjected is not only comparatively light, but is of a character which asphalt pavement is best suited to endure.

2.—The asphalt pavements of Washington have been both constructed and maintained under rather unusual conditions. Not only have the materials used been inspected with great care, but the work of compounding and laying the pavement has been directed and supervised with intelligence and vigilance. A municipal laboratory, under the control of a recognized expert on asphalt pavements, and a municipal government of unusual ability and efficiency, free from political influence, have made it possible to maintain a high standard of excellence in pavement work.

3.—The degree in which the pavements have been kept in proper repair, and their present condition, must be considered, in arriving at a fair conclusion as to the cost of maintenance. While in this respect observation will convince anyone that the Washington pavements have been maintained in a better condition than those of almost any other city, it is clear from the report that, because of the lack of funds, the repair work has not been kept up to a very high standard, and that the condition of many of the pavements is far from ideal. On the other hand, it appears that the cost of maintenance has been greatly increased by the attempt to keep the older and most worn pavements in repair long after the time when resurfacing would have been more economical. Thus, the Commissioners say:

"Attention is invited to the necessity for larger appropriations for the resurfacing of paved streets. The pavements in a large portion of the city are from fifteen to thirty years old, and are in such condition that it is not only not economical to keep them patched, but it is impossible to keep them in fair shape. As a consequence, many of the most important thoroughfares are at present rough and uneven, holding much water in the depressions, and are disagreeable to drive or haul over. They are, moreover, hard to clean, except by unsatisfactory and expensive methods.

"From 1888 to 1892 about \$550,000 a year was spent on new asphalt pavements. Most of this is worn out and should be replaced. The pavement was originally good.

but fifteen to eighteen years is the average extreme life of asphalt, and in most cities it is less than this. These pavements are generally in the most traveled and conspicuous parts of the city."

And the assistant to the Engineer Commissioner says: "The average age of the 2,200,197 square yards of asphalt pavement covered by this table is 15.66 years. It will be observed that there are about 800,000 square yards of pavement that are over eighteen years old, a yardage that represents about 420 average city blocks, 32 feet wide.

"For several years it has been necessary to maintain by expensive repairs considerable areas that should have been resurfaced, but which could not be so treated on account of lack of funds."

PAVING AND RESULTS

It is probable, therefore, that upon the whole, the results in Washington represent fairly the cost of maintenance of asphalt pavement under the conditions that prevail in that city. But it must be remembered that cost of maintenance data is inconclusive, as they are now available to the municipal engineer. Nothing is now better established than that the life of a pavement, other things being substantially equal, is a function of the quantity and character of the travel over it, and unless we know these elements, maintenance data have very little, or at least a very restricted value. Within ordinary limits, the useful work done by a pavement is measured by the units of weight of the travel over it per unit of area, and until this fact is more generally recognized and made an element in repair records, we shall not be able to arrive at conclusions of much value.

As Washington has had a longer and, in proportion to its population, a larger experience with asphalt pavements than any other city in this country, it is worth while to note the results of that experience as they are disclosed in the specifications now in use there. Some significant departures from the prevailing practice in most other cities will be observed.

1.—The hydraulic concrete base, or foundation, while uniformly six inches in thickness, is composed of much leaner concrete than is commonly thought necessary. The ratios named are:

One part of Portland cement, 4 parts of sand, 5 parts of gravel, and 5 parts of crushed stone, all by volume.

From the sizes specified for the gravel and stone it is probable that the five parts of each used consolidate to an equivalent of about 9 1-2 parts of these aggregates, so that the mixture stated in the usual terms for cement, sand and stone, would be 1:4:0 1/2. The ratio more commonly specified in other cities is 1:3:5 or 6. Using cost prices of \$2 per barrel for cement, 80 cents per cubic yard for sand, and \$1.50 per cubic yard for crushed stone and gravel, the relative cost of these two mixtures, in place on the street, would be about \$3.96 per cubic yard for the former and about \$4.40 per cubic yard for the latter, making a difference in the cost of a six-inch base of about 12 cents per square yard. While experience in Washington has doubtless demonstrated the adequacy of this lean concrete under the travel conditions that prevail

there, it must not be inferred that it would prove satisfactory for those streets in other cities upon which the travel is much larger in volume and heavier in character. But, as the writer has heretofore pointed out, there are a large number of streets in every city where it is unnecessary and therefore wasteful to use concrete as rich as 1:3:6, particularly since the requisite strength of foundation may often be secured more economically by increasing the thickness, and decreasing the richness of the concrete, since the strength of concrete practically varies inversely as the ratio of the cement, while, that ratio remaining the same, the strength of the foundation varies directly as the square of its thickness.

2.—The variety of asphalt to be used is not specified, any asphalt which complies with the requirements of the specifications for that material being accepted. There can be no doubt that in the present condition of the asphalt paving industry this is the correct and logical position to take, but it necessarily assumes that the requisite expert knowledge and laboratory facilities are available to determine what asphalts are, and what are not, suitable for making high-class pavements. One significant clause relates to asphalts that are injuriously affected by water:

"Preference will be given to an asphaltic cement that is not readily affected by the action of water, provided it is satisfactory in other respects. If an asphaltic cement is accepted that is affected by water, some provision satisfactory to the Engineer Commissioner must be made to guard against the result of such action, and such work must be included in the price bid."

3.—It is well known that asphalt pavement usually shows the first symptoms of failure in the street gutters, where it is exposed not only to almost constant dampness, but to the street drainage, containing more or less ammonia, and often to sewage containing grease, both of which substances are injurious to asphalt. In Washington the street gutters are now paved with vitrified brick, which effectually resists deterioration from these causes. The practice might be, with great advantage, more generally adopted than it is at present, in other cities.

STREETS OF NEW ORLEANS

**Only Small Percentage of Hundreds of Miles Are Modern
—Plans for Extensive Improvements Under
Consideration by City Council**

By W. J. HARDEE, City Engineer

THERE are about 525 miles of streets in the presently improved area of the city of New Orleans, 232 miles only of which are paved. Much of this pavement is of antiquated character and inferior quality; about 60 miles only is of modern type and satisfactory quality—that is, asphalt, small granite block, and vitrified brick. As the city is growing rapidly it is estimated that in six years the improved area will embrace approximately 570 miles of streets.

The city's portion of street paving is paid for out of what is styled the Reserve Fund; this fund is 20 per

cent. of the revenues derived by the city from a ten mill tax on real and personal property, and from licenses, fees, etc. The Reserve Fund for this year amounts to \$491,606.74. About 40 per cent. only of the Reserve Fund is annually expended for street paving, the balance being expended for other public improvements. The city is privileged by law to anticipate its Reserve Funds for ten years, and this anticipation has already been exercised from the present year up to and including the year 1910.

As the amount of paving that should be immediately undertaken is so far beyond the present and immediate future revenues of the city, I have prepared and submitted to the City Council a project for capitalizing two-thirds of the Reserve Funds for the next fifty years, which would yield something like \$16,000,000, about three-quarters of which fund would be expended during the next six years for street paving, and the balance to be expended during the same period of time for other public improvements, the cost of which is presently paid out of the Reserve Funds.

STREET WORK IN MINNEAPOLIS

**Amount of Paving and Method of Procedure in Progressive
Minnesota City—Wood Block and Other Materials
—Test by Federal Government**

By ANDREW RINKER, City Engineer

THE steady growth of the city of Minneapolis is perhaps best illustrated by the fact that on January 1, 1906, there were 108.27 miles of paved streets, which may be computed in roadway twenty-seven feet in width, as follows: Asphalt sheet, 15.32 miles; we are this year resurfacing about 114,000 square yards of this asphalt pavement; brick, 19.1 miles; our brick is all laid on concrete base with various kinds of filler; creosoted wooden blocks, 9.37 miles; cedar blocks, practically 25 miles; of this pavement there is more than 20 miles that is practically worn out and will have to be removed in the near future.

During the past three years we have laid some little cedar block paving on concrete. The larger amount was laid on pine plank floor and cost originally about \$1.00 per square yard; granite, 13 1-3 miles; we expect to remove a certain portion of this granite this season and replace it with creosoted wooden blocks; macadam, 12.18 miles; macadam paving costs about \$1.10 to \$1.20 per square yard in this city; sandstone block pavement laid in this city is Kettle river sandstone and is quarried at the Kettle river quarries near Duluth, Minn. (We have a total of 17 3/4 miles of sandstone paving.) A considerable portion of this pavement is laid on concrete base, while the remainder is laid on natural sand foundation.

During the coming season we have ordered, and there will be laid, about \$440,000 worth of paving, as follows: 55,000 square yards of creosoted wood block at \$2.65 per square yard; 12,076 square yards of sandstone at \$2.00 when laid on sand, and \$2.60 when laid on concrete base; 10,000 square yards of brick paving at \$1.85 per square

yard; 14,300 square yards of macadam paving at \$1.20 per square yard. This amounts to \$385,000, with \$50,000 yet to apportion.

It will be noted that the largest amount of paving ordered this year (that is, of any one kind) is creosoted wood block paving, which is 55,000 square yards. Previous to this year we have laid practically 140,000 square yards of this same kind of paving. While it is really the most expensive pavement laid in this city, it seems to be meeting with the greatest favor among the citizens, and particularly those who have to pay for it, than any of the other class of pavements named. It has numerous advantages over the other kinds of pavement, inasmuch as it is comparatively noiseless; there is less wear and tear on vehicles and horses traveling over it; it is sanitary; and, from all the information that we have been able to get on the subject, it will last at least fifteen years. We have laid nothing, so far, of less depth than 4-inch blocks, while many cities are adopting blocks not exceeding 3 and 3½ inches in depth. We believe that, outside of the fact that the block may not wear out from abrasion, the 4-inch block is the least liable to split and more liable to remain in its position than the shallower blocks.

CEDAR BLOCKS SERVE WELL

All of our cedar block pavement, except such as has been laid in the last three or four years on concrete base, is absolutely worthless as a street pavement, and, as above stated, will probably be removed shortly. We have laid a total of 1,120,000 square yards of this cedar block paving, costing us less than \$1.00 per square yard. It has answered its purpose well and should have been removed after a period of seven or eight years and replaced with some other pavement. As a temporary pavement in a new city, we felt that the money invested in the old cedar block pavement has been well invested.

It is a custom of our City Council, when ordering all classes of improvements made, to defer largely to the wishes of the abutting property owners, and to permit them (within reason) to choose the class of pavement that they desire.

The asphalt resurfacing, which is now being put in, covers 114,000 yards, for which we are paying \$1.50 per square yard, and is being done by the Barber Asphalt Company, to be paid for in five years. That is to say, one-fifth of the total amount of the assessment against the abutting property is returned to the company for a period of five years.

We have what is known as a permanent Improvement Revolving Fund. Out of this fund is paid the property owners' portion of the paving, and they are assessed and pay their taxes in five annual installments, with 5 per cent. interest on deferred payments. Street intersections and such property as is not subject to special assessment is paid for by the city, out of what is known as the Permanent Improvement Fund, a levy for which is made by the Board of Tax Levy of the city, and generally amounts to about 25 to 30 per cent. of the whole cost of the pavements laid each year.

The United States Forest Department, in connection with the Engineering Department of this city, has decided to make a test of various kinds of wood treated with creosote oil, in this city. Nicollet avenue, between Washington avenue and High street or the Union Station, is to be set apart for said test. The Forest Department is to secure the various kinds of wood, the creosoting companies to do the creosoting, the city of Minneapolis to furnish the foundation and lay the pavement and keep a record of traffic and the general conditions to which said pavement is subjected; the object of said test being the determination of the relative merits of the cheaper classes of timber for paving purposes when treated with the so-called creosote or creodone oils. The present specifications of the city of Minneapolis, for the treatment of wood blocks, are to be adopted for the purposes of the test.

Excepting asphalt pavements, all the other pavements are laid by the city by day labor. All the material and supplies necessary to do the work are either contracted for or purchased in the open market by the City Engineer, as the Council may direct.

STREET WORK IN WILMINGTON, DEL.

Much Accomplished on Meager Appropriation in All Lines, Including Sewers—Total Area of Thorough- fares—Those Improved

By GEORGE ROMMELL, JR., Chief Engineer

THE total appropriation for the Street and Sewer Department of Wilmington, Del., exclusive of new paving and sewers constructed, is \$100,000, while the duties devolving upon it are numerous, including street cleaning, street repairs, removing of snow, sprinkling, grading and opening streets, crossings, curbs, lighting, sewer extension, and the removal of ashes, but not garbage.

There are in the city 93 miles of streets, of which 59 miles are paved as follows:

Rubble, 1,073 miles.

Granite block, 11.98 miles, at a cost of \$2.31 per square yard.

Asphalt block, .25 miles.

Asphalt street, .49 miles, at a cost of \$1.80 per square yard.

Bitulithic, .46 miles, at a cost of \$1.95 per square yard.

Vitrified brick, 14.48 miles, at a cost of \$1.75 per square yard.

Macadam, 19.17 miles, at a cost of 66c. to 89c. per square yard.

Street cleaning is done by hand in a fairly effective manner, assisted by one machine, and as the city is hilly the rains wash it to a great extent. This is of advantage in paved streets, but on macadam it washes and necessitates considerable repairs, but the city owns a good plant with two road rollers and repairs all streets.

The cost of building sewers from April, 1887, to January, 1904, has been \$918,600 for 61.17 miles, and the cost of repairs and cleaning, \$72,666. The returns for sewer permits and assessments were \$356,265.

During the past two years considerable additional work has been done, chiefly a reinforced concrete sewer, which was a marvel of economy and engineering skill, the cost for 10-foot sewer being \$15.37 per foot, as against \$26.76 for the same size sewer previously built of brick and cement. A report of T. Chalkley Hatton, Consulting Engineer, gives an interesting description of the work. Mr. Frank W. Pierson is Commissioner of the Department and Leslie V. Christy, secretary.

THE STREETS OF CROOKSTON

Minnesota City Sets Pace for Towns in Red River Valley —Has 18,000 Yards of Best Asphalt Paving— Proposed Improvements

By J. E. CARROLL, City Engineer

THE city of Crookston, Minn., has approximately 18,000 square yards of the best asphalt paving to be found anywhere. This paving was laid in 1903. It is of Trinidad pitch lake asphalt (laid by the Barber Asphalt Company, J. B. Robbins, Supt.) as follows: 5-inch concrete base made of Milwaukee cement and gravel, mixed in the following proportions, 1, 2, and 5; 1 inch of binder, made of crushed limestone and asphaltic cement; 1 1-2 inches of wearing surface. It has not been found necessary to make any repairs so far, neither will it be necessary to make any this year.

Granite curb is used. At corners of street intersections, a 10-foot radius curb is used. All street intersections are raised. Storm water is intercepted before reaching crosswalks by inlets cut in the curb or by convex grated top catch-basins. The center is set two feet out from the curb and five feet back from the property line, if produced.

Particular attention was given to grading the sand for the top surface, and to the preparations of the asphaltic cement. The resultant mixture, having some carbonate of lime dust, was rich in cement, and when laid in the street was readily plucked by horses traveling over the same. The mixture was the reverse of a lean one, samples of which are very numerous. By way of digression, it may be said this was the first paving laid here, and when the first block was laid and opened for travel considerable anxiety was displayed by some as to how long such a pavement would endure. One individual, after a few minutes' labor, had picked up a handful of pieces, plucked out by the sharp-shod horses, and displayed them to everyone who would listen to him, at the same time arguing with delsarte accompaniment how ridiculous it was to undertake paving with such stuff. Finally the paths of the "muck raker" and the writer crossed, and the question of right of way was soon settled. After listening patiently to his arraignment of the job, I produced a piece of red kiel, and after getting him to admit that he might get a bushel of such pieces plucked during the day, and making it two for good measure, I proceeded to figure out for his benefit how long the pavement would last

under such conditions. A few minutes' figuring showed him that it would take about seventy years to remove practically all traces of the paving. You may be sure we had an audience. The result was that he fled. The figures carried conviction.

We expect to put in at least 16,000 square yards of paving next year. The property owners have petitioned for asphalt. Representatives of other kinds of paving have tried to induce the property owners to choose their make, but without success. We have about 23,000 square yards of 3-inch granite top, 6-inch sandstone base, macadam paving. It has been down two years and is giving satisfaction.

CLEAN STREETS A FEATURE

Particular attention is paid to keeping all our streets clean, especially those in the business district. We keep four men employed daily on the paved streets. They are termed "white wings." A small push-scraper and brooms are used in the removal of litter and offal. Galvanized iron receptacles for waste and paper are provided at each corner. The agitation for neat streets and the results are due mainly to the Ladies' Improvement League and to our local newspapers. They have created a desire among the citizens to have as good, if not the best, cleaned streets to be found anywhere.

We have about three miles of graveled streets in the residence part of the city and on roads leading out into the country. On the residence streets that are graveled, 3x10-inch pine plank curb, securely nailed to 5-inch by 3-foot cedar posts, spaced five feet apart, is used. The cost of this curb is about 11½ cents per lineal foot, set in place.

Our gravel for streets is found inside the city limits. It has such a large percentage of clay in it and is of such a nature, that it is impossible to wash the clay out in order to make it suitable for concrete work. However, used as we find it, when spread and rolled, an ideal road is the result. When thoroughly compacted by travel, it is water-tight and smooth. We have set such a good example up here in this, the Red River Valley, that our neighboring towns are beginning to emulate it.

We have put in several miles of artificial curbs during the last few years. Inasmuch as the sand and gravel for making the same has to be hauled a distance of about 18 miles, the cost per lineal foot for curb is about 60 cents.

A general law of the State, passed in 1895 (see Chapter 235, General Laws of the State of Minnesota for the year 1893), and amended in 1899 (see Chapter 128, General Laws of the State of Minnesota for the year 1899), makes it possible for us to get modern improvements, like sewers and paving. This law has not been taken advantage of as much as it should be. However, the sentiment for good roads has taken a firm hold here. As a result, I look for all means toward the betterment of highways to be taken advantage of.

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NEW YORK, JUNE 6, 1906.

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Choice of Street Pavements

PROBABLY few engineers engaged upon city work have not at some time or other been asked "What do you consider the best kind of pavement?" The answers have undoubtedly been various, most of them non-committal; and the latter may have given the impression to the questioner

that the engineer did not know his business—as just a conclusion as though it had been made with reference to a physician who had been asked, "What do you consider the best kind of medicine?" Durability, for instance, is always desirable, but in many localities noiselessness is of more importance, and granite block should there yield place to, say, wood block or asphalt. Of all the pavements, proprietary and other, which have won any popularity, there is probably none which is not the best for some localities, nor any which is the best for all.

But there is need for a full discussion of the conditions under which each of the various characteristics is most important. Where is noiselessness most important? Where appearance? Where, if at all, should cheapness or durability be the controlling factor? Is it true that a tar macadam pavement does not wash or ravel out on steep grades? And what are the relative efficiencies in each soil and latitude of "bitulithic," "tarvia," "westrumite," etc., in this respect? Is wood block the least noisy pavement? Is block asphalt less slippery than sheet? Is macadam the most economical pavement in construction and maintenance? What are the disadvantages (besides high price) of each of the modern patented pavements? The profession will welcome the expert who is bold enough to answer these and similar questions, and sufficiently wise and experienced to prove his answers.

Even though engineers generally cannot always correctly diagnose conditions affecting paving, and wisely prescribe for them, should the selection be made by a committee of business men or other non-experts? These ordinarily base it upon the results apparently obtained in their own or other cities on streets whose conditions are seldom the same as those affecting the problem in question. In many cities the owners of property are allowed to decide what kind of paving shall be placed in front of it, frequently even without having presented for their consideration an unprejudiced statement of the relative suitability of various pavements. Such a decision, when it is not due to the activity of a paving company's agent in obtaining signatures to a petition for his kind of paving, must almost invariably be based upon a modicum of knowledge or upon prejudice. Is an individual merchant, lawyer, or laborer as capable as a City Engineer of choosing wisely? If not, is combined ignorance (or worse, half-knowledge) more reliable than that of individuals? There have been many municipal experiences illustrating the saying that "the best intentions of an ignorant man are more dangerous to a community than the selfishness of a wise one." If this practice is based upon a popular idea that the question is not an engineering one, it is the engineer's duty to correct this impression; if upon the belief that the City Engineer is incompetent to decide it, the proper solution is to place the decision, not in the hands of a number of even less competent men, but rather in those of an expert—or to engage a City Engineer in whom they do have confidence. We believe that there is no class of corporations other than municipal ones in which the stockholders at large or even the directors pretend to decide technical questions, and that municipalities continue to be the exceptions only to their great disadvantage.

A Mayor's Troubles

A VERY interesting article—if not a whole volume—might easily be written or compiled concerning the varied duties that a Mayor is called upon to perform during his term of office. These duties are, however, not by any means the greatest of his Honor's troubles. He has to supply—out of his own experience—and maybe at any given moment—a knowledge of the thousand and one things that make up the sum of the welfare of the people of his municipality. Truly is he the father of his city, oftentimes mother and nurse as well. Improvement, apart entirely from actual government, must be constantly in his mind. The question of what can I do to better things must ever be to him a perfect Frankenstein. It is with him morning, noon and night. He can not shake it off. He lives, eats and sleeps in the thrall of official multifaria. There is little peace for him anywhere. The maintenance of a proper dignity; the pleasing of political friends and enemies, the placating of this man or that and the rounding the corner of a difficulty are his also, his eye being in the meantime on the general prosperity and growth of his territory should he desire to peacefully retain office and the well-wishes of his fellow townsmen who elect him. It is no joke, the Mayoralty of any place. There is little fun in it for any man who wants to discharge his duties conscientiously and well. To carry on his work, apart from instituting reforms, which every Mayor is pledged to do, requires the tact of a book canvasser, the patience of a Job, the humor of a Twain, the digestion of an ostrich, the physique of a Hercules and a cast-iron back. Individuals possessing qualifications such as these are wanted in other much more profitable branches of work than that of a Mayorship of a perhaps ungrateful city and a restless, critical set of citizens. It says much for the country at large that proper men qualified to fill these irksome, selfsacrificing positions can invariably be found.

English Laws on Smoke Prevention

IN the year 1396 one John Blank (a cousin of the American "John Doe") was tried, condemned and executed, for burning coal in the city of London. That law, however, appears to have fallen into innocuous desuetude, for at the present time the emission of smoke from chimneys may be dealt with throughout England, where that emission is a nuisance, at the common law, or where that emission offends against the Public Health Act of 1891, or against similar provisions under local acts. To constitute a nuisance at common law there must exist injury to health or property or discomfort to individuals. Where an individual has sustained, or is about to sustain, an injury, he may invoke the law by bringing an injunction or he may recover compensation for damages already incurred. It is not necessary to show that any particular kind of smoke has been emitted, or whether it comes from a factory or a private dwelling. The ma-

terial question is, in all cases, whether the annoyance produced is such as materially interferes with the ordinary comfort of human existence. Under the Public Health act means are provided for dealing summarily with the nuisance of emitting black smoke from a factory chimney. Among the local acts, that of the town of Nottingham seems simple and perfect; it simply provides that if any fireplace or furnace is so constructed as to prevent the burning of smoke, that the owner shall be fined and that any fireman negligently using any furnace so as to produce smoke shall also be fined. There is a concerted movement on the part of the Smoke Prevention Society and the Sanitary Institute to have the smoke laws revised and consolidated, but a return to the provisions of the fourteenth century laws is improbable.

Specific Specifications

THE most indefinite thing in life is indefiniteness and the most difficult thing to do is to give clear, definite instructions that can be instantly comprehended. In reality, how very few people thoroughly understand the exact values of even yes and no. They are so apt to look upon them as mere affirmatives and negatives. Nowhere more than in the world of public work and construction is indefiniteness exhibited. Specifications are drawn up, estimates made out and contracts entered into, based upon details and directions that are as devious as they are distracting. The curate who telegraphed to his parochial coadjutors that the motto he had selected for the coming festival was "Unto us a child is born. Six feet by two," meant well, but he was ambiguous. The man who ordered by wire a piece of flooring 3 x 3, when it arrived in yards instead of feet, as he only wanted to repair a worn away patch, was amazed and upset. So on all along the line. Time wasted, money thrown away, patience exhausted, tempers taxed and misunderstandings difficult of adjustment are caused by the want of clear and concise instructions. Such a frazzled fiasco as that which has occurred in Fredonia, N. Y., and particularized in another part of this issue under the heading of "A Failure of Tarred Macadam," probably never would have occurred if the specifications had been as distinct as they should have been. To make a specification, first thoroughly understand it yourself, then see that the other fellow understands it. By adopting this plan much bad blood and more bad work will be avoided.

Improved Cement Block Construction

CEMENT blocks will win their way as a standard building material through improvements in the blocks themselves and by adaptation of house plans to the peculiarities of the material. The greatest defect of the cement block—not unknown in the case of other building materials—is its tendency to absorb and retain water. Although the best blocks that can be made absorb very little water, poor ones absorb a large percentage and there are all sorts of intermediate grades. A glance at a cement block wall after

a rain serves to verify this, as some blocks will appear much darker than others, the difference in color giving a very good indication of the amount of water retained. To remedy the defect without using an excessive amount of cement, the sand and screenings used may be so proportioned as to reduce the voids to a minimum; a fine mineral powder or lime will still further increase the density. This practice is unobjectionable because the amount of cement required to make a block of sufficient strength is not enough to make a water-proof block. In connection with this subject block manufacturers would do well to study the investigations that have been made on sands by Mr. Clifford Richardson and others. The other way of adapting the plan of the house to the peculiarities of the material is being met very successfully in the construction of suburban homes and artistic results secured by building the lower story of cement blocks and the upper story of wood. The use of blocks throughout a house has frequently a monotonous tendency, while the use of blocks in the lower story permits effects that are impossible in an all-wood house. A liberal covered piazza on three sides of the house completely protects the walls from rain. Blocks may be used in the upper story, too, if the building is provided with an overhanging roof which protects the wall to some extent and also produces a pleasing effect.

Studying Problems

THE Civic Federation has appointed a committee of twenty-one to investigate public utilities in foreign cities, the specified utilities being transportation, lighting and water supplies. The committee sailed about a fortnight ago and is now doubtless industriously going about seeking what it can assimilate in the shape of practical knowledge of things as they exist municipally abroad. We should like to have seen the committee a trifle more representative in character, because any report presented by it will, naturally, be judged by the experience of the men making it. The members of the committee, while all estimable men, are not quite what might be termed "experts," and for this sort of investigation work surely "expert" work is called for. Nevertheless, we shall gladly welcome the report, which cannot fail to be interesting even if it should not be convincing, as it will doubtless be made in good faith and in all earnestness. In addition to the three subjects indicated above, the committee might with much advantage look into such things as street paving, repairing and cleaning, nearly all of which are much better done in Europe than in the United States. The accommodations for the street car traveling public will also be well worth investigating, as some good lessons can be learned therefrom. The effectiveness and civility of police officials would entail special consideration, the conveniences found in public lavatories (particularly in London), so that we may have hopes of a much lessened use of saloons, is surely worth attention because the want of proper accommodation in this regard for both men and women is a stark, staring disgrace to New York City. The clearing of sidewalks and curbs, together with the proper care of both, that make European cities a pleas-

ure instead of a nuisance, will surely repay attention. How uneven coal hole and underground shaft covers are handled would also form a useful study. How cities in other countries are treed and ornamented. How monuments (not manikins) are sculptured and set up. How public fountains and water supplies for man and beast are erected and maintained will well reward the onlookers. Window gardening, park-seating, the making of boulevards, the treatment of vacant spaces, all will reveal pleasant surprises. These and a hundred other things will repay careful examination with a view to their adoption wholly, or in some modified form, in this country, and will startle the committee considerably, as will also the fact that there are many utilities in this country which might, with great advantage, be instituted in the several foreign countries the committee purpose visiting. There is always something to learn everywhere, even outside of America.

Not a Bad Idea

Whether workable or not has to be proved. The Superintendent and Engineer in charge of the Jamestown Exposition to be held in Virginia next year, makes a statement which is interesting, even if the anticipated results should not pan out satisfactorily. It is that, recognizing the strong feeling that is not altogether unjustly expressed against the enormous sums of money invested in the erection of buildings for Expositions, generally, and the eventual wreck that follows their temporary use, the Jamestown Exposition is to be different from all others in this respect. Situated, as it will be, on the banks of one of the most beautiful bodies of water in the country and in close proximity to Newport News, Norfolk, Portsmouth and Old Point Comfort, it would make a most desirable location for a permanent city, or at least an all year round resort. In view of these facts, the buildings to be erected by the various States and the majority of the Expositions Company's buildings are to be of a solid, permanent character, that all the water, sewer and drainage systems shall also be built in the same permanent manner and that the whole block of land shall be laid out into streets and town lots on which the various buildings will be systematically located so that by these means the nucleus of a handsome future city will be set up. As the company owns every foot of the four hundred acres of land it can do this and thus prevent the inevitable waste of material that marks the trail of once held expositions which remain unpleasant and unprofitable eye-sores. Mr. Chas. H. Pratt, the Superintendent and Engineer in charge, is enthusiastic and believes that the outcome will be a valuable architectural and practical addition to the State of Virginia, and a monument as to what can be done in this regard. We shall look forward to a community of this kind with interest as, if success attends the well-intentioned efforts of the promoters, the unpleasant aftermath of Expositions will have been avoided. The many unsightly remnants of expositions still existing in the United States are, to promoters, very unencouraging reminders.

THE DISPOSAL OF MUNICIPAL WASTE

With Special Reference to American Conditions—Comparison of Ashes—The General Question of Utilization—Tables of Comparative Values—Various Methods of Sorting

By WILLIAM F. MORSE, Sanitary Engineer, New York

This Series of articles begun in the February number, will be continued until completed and will be illustrated by original drawings, cuts, diagrams and pictures, and contain many tables valuable for reference.

The Subjects Already Treated by the Author Are:

1. The Waste Collection Service in American Towns; Methods and Results.
2. Definition of Terms; Quantities; Proportions; Character of Waste in General.
3. Garbage; Analysis; Proportions; Values.
4. Dry Refuse and Rubbish; Quantities and Treatment.
5. Classification:—Commercial Values after Recovery.
6. The Refuse Utilization Stations in New York, Boston, Buffalo, and Brooklyn (Illustrated).
7. Municipal Ashes; Analysis; Proportions; Values when Separated.
8. Ashes from Cremation of Garbage; Analysis and Values; Comparative Table.
9. Comparison of ashes from English and American Cities; Cremation Means.

The Following Are to Appear:

10. The Utilization of Municipal Waste in General; English and American Methods.
11. Commercial Values of Refuse and Ashes when Marketed and Manufactured.
12. The Analysis of Garbage; Tankage, Its Value (Special Tables).
13. The Garbage Disposal Plant, Cleveland, Ohio.
14. Street Sweepings; Fertilizing Value and Treatment.
15. Comparative Commercial Values of Waste.
16. Methods of Disposal; Cremation.
17. Beginning and Progress.
18. Apparatus and Furnaces; Record of Work (Illustrated).
19. Apparatus and Furnaces; Record of Work; Results.
20. Types of Furnaces; Their Employment; Municipal, Institutional, Industrial, Medical, Laboratory (fully illustrated).
21. Calorific Value of Waste as Fuel (comparative table).
22. Reduction and Extraction Process Described and Illustrated; the Earlier and Later Methods.
23. Foreign Destructors; Special Chapter by an Eminent Authority.
24. American Methods; Col. Waring and His Successors.
25. Present Situation in This Country; Résumé.
26. Means for Improvement as Suggested by Several Investigators.
27. What May Be Expected of the Future.

ASHES FROM THE COMBUSTION OF ENGLISH TOWNS' REFUSE

Under the English practice of burning all house refuse and ashes in furnaces operating at high temperature under forced draft, the residuum of ash and clinker is thoroughly calcined and freed from organic matters. There is a small amount of fine dust deposited in the combustion chamber and dust catchers of the furnaces, which is used as the basis of several kinds of disinfecting powders. The clinker, which is removed through the firing and stoking doors of the destructors is screened, ground, and mixed with hydraulic lime and cement, and is formed into paving blocks, flagging, tiles, bricks, and gravel for concrete filling instead of broken stone. At Liverpool some of the smaller municipal buildings are made altogether of this material, and the blocks and bricks used are suitable for many kinds of construction work, as they can be moulded in any form or made in any color. When properly seasoned these bricks are fifty per cent. stronger than the ordinary building brick, and are manufactured at far less cost.

The best selected clinker from English destructors is so perfectly vitrified that it is in demand for use on the filter beds of sewerage works, and is found to perfectly supply the place of an equal volume of broken stone at much less than the cost of the latter.

TABLE XVIII. ANALYSIS OF DESTRUCTOR ASHES (GOODRICH); FROM REPORT OF MR. J. M. TAGGERT, BRADFORD, ENG.

	SAMPLE	
	Fine	Medium
Silicious matter.....	61.08	67.10
Iron and alluminia Oxide.....	21.50	19.30
Carbonate of Lime.....	7.80	6.
Magnesia.....	Traces	Traces
Organic and Volatile Matter.....	4.12	1.80
Moisture.....	5.50	5.80
	100.00	100.00

The clinker from destructors burning mixed garbage, refuse and ashes, and operating at a temperature of 1,800° to 2,500°, is a very different product from the ashes of American crematories burning garbage and refuse only, at a temperature of from 600° to 1,500°.

No American form of crematory has yet succeeded in burning large quantities of mixed municipal waste (garbage refuse and ashes) with any reasonable success. It is not, indeed, attempted, nor is the form of furnace suitable to obtain and continue the higher temperatures reached in British practice. It is possible for American furnaces to attain high heat for brief periods, and under certain unusual conditions a clinker may be formed that is similar to the one described above, but this is the exception, not the rule. The American garbage crematories deal only with garbage and refuse under natural draft conditions, and do not attain the highest temperatures nor produce an ash that is completely vitreous and free from organic matter. On the other hand, there is a value to American crematory ash that should be taken into account when the values of all waste materials are considered.

ASHES FROM AMERICAN CREMATORS

Fourteen years ago the writer caused an analysis to be made of the ashes from the Engle Crematory in Des Moines, Iowa. This analysis gave the following proportions of fertilizing elements:

Calcium Carbonate	8.007
Magnesium Phosphate	3.010
Calcium Phosphate	66.855

In transmitting the analysis Prof. Call, of Drake University, Iowa, after preliminary observations on the relative quantities of the constituents, says:

"Now as to the usefulness of this ash; I believe that the analysis shows this material to have value for fertilizing purposes. There is a relatively small amount of

insoluble matter, and a large amount of matter which can be readily dissolved in water, and by the ordinary processes of nature made useful . . . I have no hesitancy in saying that this sample shows a high grade of value."

The opinion of Prof. Call has been confirmed and supplemented by the opinions of others, and the value of the ash is well established. The following table gives several analyses of garbage ash, and for the purpose of comparison an analysis of wood-ash, a well-known commercial fertilizer, is added:

TABLE XIX. COMPARATIVE ANALYSIS OF THE ASHES OF GARBAGE AND WOOD ASHES

EXPERIMENTAL STATIONS	Number of Analyses	Moisture	TOTAL POTASH			TOTAL PHOSPHORIC ACID			Sodium Oxide	Calcium Oxide (Lime)	Magnesium Oxide	Ferrie and Aluminic Oxide	Insoluble Matters
			Maximum	Minimum	Average	Maximum	Minimum	Average					
Hatch Exp. Sta., Mass. Agr. Coll., Amherst; ashes from cremation of swill	15	4.86	8.83	1.25	3.97	32.36	7.47	14.16	33.38	1.87	4.65	21.57	
The same ashes from cremation of garbage	3	3.01	6.01	3.72	5.13	10.21	7.16	8.77	15.65	20.22	1.16	9.22	28.42
New York Agricultural Exp. Sta., Geneva; ashes from cremation of garbage	7	6.	.25	2.8	.....	15.4	1.7	8.7	21.1	.....	.....	.....
Iowa Agr. Exp. Sta., Des Moines; ashes from cremation of garbage	2	.77	6.01	5.68	5.84	10.21	7.16	8.68	15.65	16.7	1.16	9.32	28.41
Hatch Exp. Sta., Amherst; wood ashes	340	11.17	8.86	1.12	5.63	2.82	.06	1.32	34.54	3.31	7.43	18.28	

TABLE XX. AVERAGE PER CENT. OF INGREDIENTS CALCULATED IN POUNDS PER TON OF 2,000 LBS.

	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.	lbs.
Hatch Experimental Station; garbage ashes	78	.....	91	.....	229	339	538	39	138
" " wood ashes	233	.....	113	.....	23	691	66	149	366

Although there are no nitrates found in garbage ash there is a large amount of calcium oxide (lime) present in its superior form. When animals are burned with the garbage, the ash is rich in phosphate and lime.

The value of ashes for land dressing does not depend altogether upon the amount of soluble phosphates and acids which by chemical analysis are shown to be present, but is due also to the fact that the ashes are an assistance or addition to the ground and act as filling for the interstices in loose and sandy soil, favoring the rise and retention of moisture, and on stiff clay soils rendering the texture pliable and easily worked. It also corrects acidity in some soils by the addition of alkaline properties. In the writer's experience the use of garbage ashes as a fertilizer has been attended with uniformly successful results.

THE AMOUNT OF ASH FROM GARBAGE

Household garbage burned under ordinary conditions leaves 10 per cent. of residuum. From this is screened out the broken crockery, tins, glass, and all other foreign matter, leaving about 5 per cent., or 100 lbs. of ash per ton of garbage available for use. This is a conservative estimate, and is probably less than the average.

At the present market rates the percentage of potash and phosphoric acid present, not including lime, would give one ton of garbage ash the value of \$10.81. If the content of lime be included at $\frac{1}{2}$ cent per lb. the approximate value would be \$13.50.

Canada wood ashes are quoted at \$10 to \$12 per ton.

For market purposes, garbage ashes must be kept separate from coal and refuse ashes, should be housed under cover, foreign matter screened out, and samples frequently analyzed to show the proportions of fertilizers present. The ash should include all bones even though partly calcined.

TO LESSEN COST

Considerable space has been given to the subject of refuse utilization because of the general interest in this

particular phase of city disposal work at the present time. There is a widespread desire for something better than the present primitive methods, and a very evident purpose to lessen the cost of service by utilizing such portions of the waste as are salable.

It should be borne in mind that all the work of waste utilization must be unobjectionable from the sanitary standpoint, that it must not institute or continue measures that are condemned by the health officials, and that the means provided must be efficient, economical and satisfactory in result.

THE ENGLISH METHOD OF UTILIZATION BY HAND SORTING

The method of utilization by sorting out salable articles from a mixed mass of "town refuse" brought together at one point has been severely condemned by several English authorities. The conditions attending the work at one station in London are thus reported to the London County Council by the Medical Officer and the Engineer:

"The process carried on in a London dust contractor's yard has not undergone much alteration since the following description by Dr. Ballard was written: 'On a load of dust being upset from the dust cart on the surface of the yard some men and boys proceed to sort it. They are provided with a fork and an instrument called a drag, which has a short handle and three cast iron teeth set about three inches apart, and with these they fork and

drag over the heap so as to separate from it obvious pieces of vegetable and animal refuse, bones, rags, paper, iron, crockery and glass. These are distributed, some into heaps, others into baskets; the bones are put into a bin or heap by themselves for sale to bone-boilers. The rags and paper are also usually set aside for sale; the iron and old tins are always set aside for sale, and usually also the glass, while the broken crockery, brickbats, etc., etc., are laid in a heap to be used as material for making new roads."

These are practically the same conditions that apply to American dumps where we still allow the pawing over of ashes, refuse and rubbish, and where the situation is not unlike that described above. This practice is to be strongly condemned, and should be prohibited as insanitary and in every way objectionable.

THE AMERICAN METHODS BY MACHINERY

But these conditions do not apply to the refuse utilization stations that are established in large cities and operated under restrictions that compel cleanly work. True, there is dust, but it can be drawn off by proper ventilating apparatus, and there is dirt which is burned and not permitted to accumulate. All stages of disposal work are accompanied by these difficulties, which are unavoidable but which may be regulated and made less harmful and annoying by the employment of adequate means.

In this method of utilization by sorting at central stations the daily collection of wastes, the burden of the system comes upon the householder, who must do the first sorting. If there is no separation in the first stage then there can be none thereafter that is complete and satisfactory.

The householder, therefore, is the one that makes it possible for something to be saved, but he profits only in an indirect way. The separately collected garbage goes to a reduction company that agrees to accept payment from the city for its disposal upon condition that clean swill is delivered to the company. The rubbish and dry refuse, in all cases cited except one (New York City), goes to a contracting company that benefits by the benevolent action of the housewife, who gives it clean paper to handle. The sole actual benefit that the householder receives is the removal of matter that has become offensive or embarrassing and with which he cannot deal alone. In places where there are no contractors and no municipal force to perform the service he must pay for its removal, out of his own pocket, from five to ten times the amount

he would be assessed for the service on his property valuation if the town performed its work properly.

APPROXIMATE COMMERCIAL VALUES OF MUNICIPAL WASTE

If garbage, refuse and rubbish, coal and clinker and other waste products of the city can be successfully dealt with by the contractors after being delivered to them in a separated condition, and if such work be remunerative to the contractors, why should not the town itself do its own work of waste disposal and recover at least a part of the profit it now allows others to make, applying this profit to the expense of the collection and disposal service?

There are several reasons for the present contracting methods. It has long been the custom to allow this work to be done by contract, and it is often difficult to break through traditions and precedents, and the personal influence, political pull and actual graft that too often govern matters of this kind. But modern, sanitary and economical methods can be established if the town authorities are willing to investigate and to act upon their convictions.

In the following tables the commercial values of municipal wastes are stated according to present market quotations:

TABLE XX. APPROXIMATE VALUE OF GARBAGE AND ITS ASHES

THE ELEMENTS OF GARBAGE	ONE TON OF RAW GARBAGE			ASHES FROM ONE TON OF GARBAGE			ONE TON GARBAGE ASH		
	Per Cent.	Amt.	Value	Per Cent.	Amt.	Value	Per Cent.	Amt.	Value
Solids.....	35.	700	....	5.	100	....	lbs.	lbs.	....
Moisture.....	65.	1,300	....	5.	100	....	....	....	....
Potash at 4c. lb.	.65	13	\$.52	4.11	4	\$0.16	4.11	82	\$3.28
Phos. Acid @ 3c. lb.....	.15	3	.09	9.44	9	.28	0.44	108	5.94
Lime at 4c. lb.....	....	....	....	22.60	22	.11	22.60	452	2.26
Nitrogen at 10c. lb.....	.65	13	1.30	....	....	....	....	....	....
Residuum of Solids.....	....	671	....	....	65	....	....	1,268	....
Total quantities and Values....	....	700	1.91	....	100	.55	....	2,000	11.48

NOTE.—In estimating the garbage the free water is not included, hence the larger amount of solids. The grease not possessing fertilizing value is also omitted.

The value of a ton of ashes in an unsorted condition is practically nothing except for ground filling. A load (1,500 lbs.) of this brings from 10 cents to 25 cents, according to the demand and the cost of hauling. Although the actual values in coal, clinker and fine ash are there, they must be established by the separation and utilization

TABLE XXI. APPROXIMATE VALUES OF RECOVERABLE COAL, REFUSE AND RUBBISH

ONE TON OF HOUSEHOLD ASHES									ONE TON OF REFUSE					
Recovered Coal from New Coal at \$5.50 a Ton			Clinkers and Coarse Ash			Fine Ash			Destroyed			Utilized		
Per Cent.	Amount	Value	Per Cent.	Amount	Value	Per Cent.	Amount	Value	Per Cent.	Amount	Per Cent.	Amount	Value	
25.	500 lbs.	\$1.37	30.	600 lbs.	\$1.24	45.	900 lbs.	\$1.24	51.	1,020 lbs.	49	980 lbs.	\$2.45	

of the several parts. This can be done economically on a large scale only, with large volumes of ash to deal with, and with a market for the several portions. The coal in ashes will always be salable; the clinker is coming more into use, and the fine ash is already being manufactured with lime and cement into building bricks of any desired color, possessing greater strength and density than ordinary brick, to which it is superior in every way. It is made in less than one-tenth the time of the ordinary brick, and is sold at no greater cost. This industry will undoubtedly be extended to include a wide variety of forms and shapes for building material in which ashes as a substitute for sand will be used in large quantities.

The value of the refuse in the above table is based upon the present market price of newspaper "commons," or the lowest class of printed matter sorted from city collections.

The quotations for the other classes of refuse are as follows:

TABLE XXII. MARKET QUOTATIONS FOR REFUSE

	PER 100 LBS.	PER TON	
Paper 7 grades.....	\$0.25 to \$0.80	\$5. to \$16	
Rags 6 "	.30 " .85	6. " 17	These are wholesale prices for car-load lots. The
Bagging 4 "	.65 " 1.00	13.00 " 20	retail prices for
Carpets 3 "	.60 " .75	12.00 " 15	smaller quantities are 15% to 25% lower.
Twines 2 "	.36 " .50	7.20 " 10	
Rubber .....	.30 " .50	6.00 " 10	

THE VALUE OF GARBAGE TREATED BY REDUCTION PROCESSES

No statement of the value of American waste would be complete unless it included some estimates of the amounts returned by garbage when treated for the recovery of its commercially valuable constituents.

There are three reduction processes—by steam only, by naphtha, and by a combination of these two in one system. Although these three methods are fairly well known there are no complete and accurate data obtainable from the companies employing them, hence all estimates in regard to them must be made conservatively.

The following table, compiled from official sources, is an analysis of the identical product of different processes in different localities :

TABLE XXIII. ANALYSIS OF GARBAGE TANKAGE

LOCALITIES—PROCESS	Nitrogen	Phosphoric Acid	Potash	Bone Phosphate	Lime
New York City, Pierce Process.....	3.4	3.1	.7	...	...
Providence, Simonin Process.....	3.5	3.5	1.	12.	...
Buffalo, Merz Process.....	3.7	3.0	...	...	...
Philadelphia, Arnold Process.....	3.	2.6	.66	...	...
Pittsburg, Flynn Process.....	3.	3.	1.15	...	...
Paterson, Merz Process.....	2.9	1.6	.6	...	5.6
Bridgeport, Holthaus Process.....	2.9	3.8	.6	...	...
Philadelphia (Terne) Maximum.....	3.7	6.	.5	...	...
" Minimum.....	2.9	3.	.25	...	...
Baltimore, Arnold Process (Gascoyne).....	2.5	2.7	.7	...	...
Penn. Experiment Station.....	2.1	3.	.27	...	...
American Reduction Co., *Brooklyn.....	1.64	8.08	1.20	...	...
Hatch Experiment Station, Mass.....	2.50	6.92	.50	...	...
Average.....	2.90	3.93	.64	12.	5.6

* This analysis, made some ten years ago from samples submitted by a company not now operating, is included, although the sample probably contained a larger percentage of animal matter than is usually present.

At the present quotations for fertilizer ingredients the value of garbage tankage is as follows:

TABLE XXIV. VALUES OF GARBAGE TANKAGE

	ONE TON OF GARBAGE			ONE TON OF TANKAGE		
	Per Cent.	Amount	Value	Per Cent.	Amount	Value
Nitrogen @ 10c. lb.....	.65	13	\$1.30	2.90	58	\$5.80
Phosphoric acid @ 3c.....	.15	3	.09	3.93	78	2.34
Potash @ 4c.....	.65	13	.52	.64	12	.48
Grease at 3c.....	3.	60	1.80	...	...	...
Tailings from solids.....	...	311	...	...	1,852	...
Water.....	...	1,600	...	...	2,000	8.62
Totals.....	...	2,000	3.71	...	300	9.00
Grease in 5 tons of Garbage.....	...	...	...	...	...	...
Total values.....	...	...	\$3.71	...	...	\$17.62

The value of garbage for commercial products lies chiefly in the amount of grease extracted. This is assumed to be 3 per cent., which equals 60 pounds from an average ton of garbage—larger, perhaps, than is usually obtained. This grease is extracted from garbage by the process of boiling the garbage with steam in digestors, and afterwards pressing out the grease and water, which are thus separated; or by using naphtha as a solvent, which is afterwards recovered from the grease. This grease is a dark brown, heavy oil containing many impurities and some moisture, and must be repeatedly refined before it is fit to be used. It is largest in amount in winter and least in summer. There is a constant market for the grease at prices which vary from 2 1-2 cents to 3 cents per pound. Great quantities of it are sent abroad for use by soap manufacturers, and a considerable amount is bought here for the same purpose.

Tankage is the solid part of the garbage that comes from the dryers after the extraction of the grease. It is mostly the fibrous skeletons of vegetable matter, with a small percentage of animal substance. The proportions vary according to the amount of water present in the original mass of material, and averages about 400 pounds of tankage to each ton of garbage.

The value depends largely upon the nitrogen present, obtained only from animal substances, and the amount of which is determined by an analysis of samples, the whole being sold upon the guaranteed percentage of fertilizing elements present. The market is not constant, as at certain seasons the supply exceeds the demand, and tankage is frequently disposed of by being burned under the boilers of the plant in place of coal. When the grease has been extracted by naphtha, tankage is often highly inflammable; sometimes there is an occurrence of spontaneous combustion. Four or five large plants have been destroyed from this or a similar cause, and many cases of fires are constantly reported from reduction works.

The manufactured material does not readily lend itself to transportation to distant places because of its bulkiness in proportion to the weight. It quickly deteriorates in character, and must be marketed soon after production. As a fertilizer it is not applied in the tankage stage, but is used as a "filler" for superphosphates or other ingredients for making a complete manure.

(To be continued).

Brevities.—BALTIMORE, Md., citizens will probably vote five loans, aggregating \$13,000,000, at the spring election in May, as follows: Paving, \$5,000,000; water, \$5,000,000; parks, \$1,000,000; engine-house, \$1,000,000, and schoolhouse, \$1,000,000. An ordinance submitting the water loan has already been acted upon by the Council.

BOISE, Ida., has completed a \$100,000 sewer and will shortly invite bids for two additional miles and \$75,000 extensions.

BOSTON, MASS., has a former editor, Stephen O'Meara, as Police Commissioner.

BUFFALO, N. Y., claims to have the smoothest street car tracks in the country and bases its claim on the records of the Automatic Testing Company.

BUTTE, MONT., will have the largest concrete chimney in the West; it will reach a height of 450 feet.

CEDAR RAPIDS, IOWA, will celebrate its fiftieth anniversary, June 10 to 16, when plans will be put in operation by city officials and committees for booming the town.

CHICAGO, ILL., according to Mr. John B. Hittell, Chief Engineer of Streets, Board of Local Improvements, had contracts May 1 for 593,104 square yards of asphalt paving, 50,550 yards of brick, 31,081 yards of granite and 519,204 yards of macadam; a total of 1,183,939 square yards, or about 74 miles. About 25 miles additional paving will be done during the season.

GALESBURG, ILL., Council recently refused to accept a flat rate of \$1.10 a thousand from the gas company and declared the company was never granted a franchise; it offers a 25-year franchise for 22-candlepower light at 90 cents, the company to furnish meters. The matter will probably be settled by the courts.

GROVELAND, PA., becomes a part of Beaver borough, according to a decision by Judge Francis J. O'Connor, which settles a long legal fight instituted by anti-annexationists.

HAVERHILL, MASS., citizens are anxious to secure the improvement of Merrimac street, the main thoroughfare of the city, and Mayor Roswell Wood will bring the matter to the attention of the Committee on Streets shortly.

INDIANAPOLIS, IND., is the present field of investigation of the engineering corps of the Insurance Committee of Twenty.

LOS ANGELES, CAL., has nineteen miles of paving under way or petitioned for, which will nearly double the paved area.

MERCHANTSVILLE, PA., is organizing a new water company and hopes to secure higher pressure.

MINNEAPOLIS, MINN., Council is considering a resolution of Alderman Lars M. Rand appropriating \$25,000 for a permanent public bathhouse at Cedar and Washington avenues.

NATCHITOCHES, LA., has placed an order with the Crocker-Wheeler Company of Ampere, N. J., for an engine, type 105 k.w., alternating current, 2,300-volt generator, to be installed in its municipal lighting plant.

NORTH YAKIMA, WASH., which is within \$30,000 of its borrowing limit since the recent \$48,000 loan for a new sewer, will expend \$185,000 for a municipal gravity water system.

PATERSON, N. J., bonded debt has increased \$305,000, according to Mayor Johnson, owing to the issuing of \$110,000 for the permanent improvement of streets, and \$275,000 for a new high school, of which amount \$108,000 has already been expended for a site.

PHILADELPHIA, PA., compels the traction companies to pave the entire surface of the streets in which tracks are laid. During recent years the corporations have expended more than \$12,000,000 paving the city streets.

PITTSBURG, PA., will soon start its asphalt repair plant with a force of one superintendent, two foremen and as many men as are required.

QUINCY, ILL., Council is considering a proposition made to Mayor John A. Steinbach and the Finance Committee by the Quincy Gas and Electric Company, reducing the maximum rate from 13½ to 12½ cents per 1,000 kilowatts for electric lights for residences, providing the city waives its claims to the wires, poles and transformers of the old Independent Light and Power Company.

SAN FRANCISCO, CAL., proposed building laws provide that on streets 100 feet wide or over the height of buildings facing thereon shall be unlimited; on streets 80 feet wide or over the height shall be limited to 200 feet, and on streets less than 80 feet wide the height may be one and one-half times the width of the street upon which the buildings face.

SPICELAND, IND., will hereafter use natural gas for lighting purposes only. Pressure is decreasing.

ST. PETER, MINN., Council proposes to have better sidewalks than any other town of its size in the State, and recently passed an ordinance prohibiting the use of any material except stone and cement. In addition, the sidewalk committee has condemned eight miles of walk, which must be replaced by the owners, or it will be laid by the city and assessed against the property benefited.

Some Unusual Fires.—ASHVILLE, N. C.—Woodyard and lumber on George W. Vanderbilt's estate, May 20. Cause unknown. Amount of damage, \$25,000.

CLEVELAND, O.—The White City, an amusement resort, May 25. Cause unknown. Amount of damage, \$150,000.

DAVENPORT, IOWA.—Smoke house of the Kohrs Packing Co., May 21. Cause unknown. Amount of damage, \$3,000.

FAIRBANKS, WASH.—The entire business district of the city burned out, May 23. Cause unknown. Amount of damage, \$2,000,000.

OCONOMOWOC, WIS.—Walther & Frederickson building, May 28. Cause, explosion of gasoline lamp in a dentist's office. Amount of damage, \$14,000.

ROCHESTER, N. H.—Kiesel Fire Brick Company completely burned out, May 20. Cause unknown. Amount of damage, \$12,000.

SCRANTON, PA.—John Schew Block, May 25. Cause, pan of grease upset. Amount of damage, \$7,000.

SOME CITIES' STREET WORK

Albany, N. Y.—During the past few years, most of the cobble-paved and unimproved streets have disappeared, and in their places are streets made pleasant to live in and drive through, paved with modern pavements, with new curbs and sidewalks, and which are kept so clean that strangers within the city comment very favorably upon them and point to Albany as a model city in this regard. Street improvements aggregating \$308,962 were completed or nearly so while improvements amounting to \$107,294.86 were under way at the close of the fiscal year. Eleven contracts for vitrified brick paving were completed at a cost of from \$2.37 to \$2.14 per square yard. Two contracts for resurfacing with sheet asphalt were done at a cost of \$1.20 per square yard. Asphalt blocks were laid at a cost of \$2.29 per square yard. Two streets were macadamized at a cost of \$1.16 per square yard.

Cambridge, Mass.—Among the street improvements of the year, was widening to 105 feet of Main street at the approach of the new Cambridge Bridge, which is approaching completion. The grade was raised eight feet in some places and the roadway paved with new granite blocks, all done by the Street Department by day labor. A contract has been made for grading the approach to the Brookline bridge, a 60-foot roadway. The city has 99 miles of accepted streets and 22 miles unaccepted; besides there are eight miles of park roadways.

Canandaigua, N. Y.—While so much has been accomplished, over one-third of the total length of the streets of the village now having permanent pavements, yet there remain a few streets where the traffic is sufficient to warrant paving, to say nothing of the increase of value to abutting property by such improvements. In addition to this, the expense of cleaning streets already paved would be reduced, as less mud would be carried on to them from the unpaved streets adjoining. The Board may be able to secure such additional appropriation, either by setting aside a portion of the amount raised annually for street maintenance, or by a direct appropriation voted by the taxpayers, as will enable it, with the help of like amounts assessed on abutting property, to pave some of these streets or a portion of one each year. With this policy pursued, it is anticipated that only a few years will elapse before Canandaigua will be the best paved village in the country.

Cincinnati, O.—There is a decided sentiment in favor of a municipal plant for the repair of asphalt and bitulithic pavements. As some contractors close their plants early in the fall, asphalt streets often go for weeks in a wretched condition.

Duluth, Minn.—During the year 17 contracts for street improvements have been let at an aggregate estimated cost of \$192,457.88. Fifteen were completed during the year and two are in progress of construction. In addition to the amount expended on street improvements ordered during the year 1905, the sum of \$2,557.72 was expended on contracts which were unfinished and carried over from the previous year.

Easton, Pa.—During the present year only \$20,000 was expended by the Highway Department as compared with over \$50,000 of the year before, when some extensive improvements were made on the South Side. While no large sums were expended on any particular streets this year, good work was done in general repair of streets, leveling depressions, etc., so that the general condition of the macadamized highways is good. In the coming year a start will probably be made in bricking Northampton street, west of Sixth, as the cost of keeping it in repair is continual and expensive. Concrete or brick paved crossings were recommended in place of flagstone which make smooth riding impossible on any street and are becoming out of date. The City Engineer states that bituminous macadam has not yet been tried, but it would be greatly to the benefit of the city if Chestnut street, which is now in need of extensive repairs, be laid with it. If the city can possibly spare the money this year it will probably oil Canal street and Dock street and Chestnut Hill.

Eastport, Me.—State Road was built from the Carrying Place to Steele's marsh; new concrete sidewalks were laid on High street and on Water street at the North End; needed repairs were made on several of the old concrete walks, including that through the business section of Water street, which was newly concreted.

Jersey City, N. J.—During the year 1905, the city improved with Belgian paving, curbing and flagging, 3,853 lineal feet, 12,019 square yards, costing \$31,502. Streets graded, curbed,

flagged and improved with asphalt, 2,569 lineal feet, 7,621 square yards, costing \$21,410. Streets graded, curbed, flagged and improved with brick, 286 lineal feet, 3,975 square yards, costing \$3,531. Streets graded, curbed and flagged and paved in gutters with Belgian blocks, 3,925 lineal feet, 3,975 square yards, cost, \$27,974.

New Britain, Conn.—During the year 1905 the city paid for "incidentally" for streets, \$13,618.69, which included almost everything from printing and blanks to labor and insurance. Only two streets during the year have been remacadamized, but a large number of streets have been top-dressed or re-surfaced; this work, however, has been held up and delayed because of the proposed sewer work to be done in many of the streets. Flag walks have been ordered laid on several streets, and the majority of the same have been laid; quite a number of walks, however, that have been ordered laid, will have to be laid during the coming year; one street only has been curbed during the year; several streets have been graded and cinder walks built on the same.

Paducah, Ky.—During the year there was only one contract let for improving streets by grading and graveling, and that was Nineteenth street, from Madison street to the Hinkleville Road, a distance of 1,022½ feet. The work has been about completed, but the contractor has not yet reported ready for its acceptance. In addition to the above there was built 1,470 feet of gravel street. So these two streets make 0.47 miles, which, added to the report of 1904, showing there were 46.9 miles of gravel streets, would make the total mileage of gravel streets now 47.37 miles. The following streets have been reconstructed during the past year with brick: Third street and Broad street, a distance of 1.22 miles. Second street, 0.07 mile; Kentucky avenue, 0.24 mile; Jefferson street, 0.25 mile. Making a total of 1.78 miles. This added to those already in condition would make a total of 2.58 miles of brick streets, and 0.31 miles of bitulithic or 2.89 miles of streets with improved material.

Quincy, Mass.—As Quincy is the home of granite, first-class city blocks are used for paving, laid on a sand foundation at a cost, including excavation, of about \$1.50 per square yard.

Racine, Wis.—The total length of streets graded to date is 221,306 lineal feet, 284,206 cubic yards having been moved at a cost of \$97,834. Paved streets to date amount to 276,651 square yards, curbing, 111,416 lineal feet, costing altogether \$359,204. As to kind of paving 92 miles are limestone, 474 cedar blocks, 4,31 brick, 2,46 macadam.

Rockford, Ill.—The Mayor in his address to the City Council stated that the guarantee for the asphalt pavement on South Main and West State streets has expired. The Street Department has been experimenting with a tar macadam for repairing this pavement and these experiments have now reached a stage where the city is prepared to offer a cheap and excellent substitute for asphalt, to make the necessary repairs which will take care of the streets until property owners can decide upon a new pavement.

Seattle, Wash.—There are approximately 800 miles of public streets laid out in the city. Including the work of 1905, there are now in round numbers 215 miles of graded streets, or a little more than one-fourth of the total number of miles of streets. Over forty-one miles were graded during the year 1905, and that is more than twice the amount graded during 1904. Of wooden and concrete sidewalks there are 348 miles laid, or 177 miles of concrete and 170 miles of wooden sidewalks.

St. Joseph, Mo.—During the year just past there has been purchased and operated a small municipal asphalt plant. This was a new departure for the city, but it has proven both profitable and expedient. Heretofore all the asphalt streets have long suffered for repairs. In the past year the small plant has been constantly at work, going over the streets, and has demonstrated again and again that "A stitch in time saves nine." The asphalt thoroughfares are in better condition now than they have ever been, and much money has been saved to the city as well as to the property owners. It is advised that a larger and more extensive asphalt plant be purchased by the city, and located on the ground near the city electric-light plant, where it may be operated by the same power as is used by the electric-light plant, thereby reducing or minimizing the expense of operation. The area within the corporate limits of the city is 9½ square miles. The lineal mileage of street, 186. The lengths of improved streets are asphalt, 8.03; brick, 16.83; macadam, 27.39; granite blocks, 51. Last year was the banner year for street paving, more streets having been paved than any year ever before. And improvements are being considered both for opening new streets and the repair of existing pavements. It is said that the proposed work will involve a considerable expenditure, although definite plans must yet be prepared and approved. The matter of street paving is deemed of prime importance.

WHO'S WHO IN MUNICIPAL WORK

ATKINS, Charles A., Mayor of Asbury Park, N. J.; born February 10, 1853, at Lebanon, Pa. Educated in public schools of Philadelphia, Pa., graduating with honors from the High School of that city. For seven years has been salesman in the woolen business. In 1877 became a partner with his father in the Ocean Hotel. Town Commissioner 1887-1897. Beach Commissioner 1904. Is a member of the Coast City Council, Royal Arcanum; Standard Chapter, No. 35, Long Branch; Corson Commandery, No. 15, Asbury Park, and Mecca Temple, No. 1, New York. *Residence, Asbury Park, N. J.*

BETZ, Louis, Comptroller of the City of St. Paul Minn., since 1902; born in that city February 3, 1862; unmarried; received his education in the public schools of St. Paul; was engaged in the book and news business for ten years prior to his election as City Comptroller. First acquired prominence through reforms instituted by him, simplifying and perfecting existing methods of publishing annual reports; is one of the directors of the League of American Municipalities, member of the National Municipal League, Vice-President for the Northwest of the National Comptrollers' and Auditors' Association; was re-elected to office by greatly increased majority May 1, 1906. *Address, St. Paul, Minn.*

EGAN, Stephen M., County Collector, Hudson County, N. J. Born in Jersey City, May 17, 1859; educated at St. Peter's Parochial School and Hasbrouck Institute, Jersey City; married. Was clerk in City Collector's office under J. H. Love, P. H. O'Neil and S. S. Smith; also Deputy City Comptroller and Clerk of Sinking Fund of Jersey City; member of Robert Davis Association, Fraternal Order of Eagles, and Jersey City Council, Knights of Columbus. *Address, Jersey City, N. J.*

FARREL, Alton, Mayor of Ansonia, Conn., was born at Ansonia, August 22, 1879. Was educated in the public schools of Ansonia, St. Paul's School, Concord, N. H., and Yale University, Class of 1902. In 1903 was appointed Aide-de-Camp on Governor Chamberlain's staff; 1904 was a member of the Board of Aldermen of Ansonia; 1905 served as Representative in the State Legislature, and was the same year elected Mayor. *Residence, Ansonia, Conn.*

PRATT, Charles H., Superintendent and Engineer in Charge Jamestown Exposition Company, Norfolk, Virginia; born in Somerville, Mass., October 14, 1861; educated in Massachusetts schools. Eight years in Engineer's Office, Town of Brookline, Mass. (wealthiest town in the United States), Superintendent of Park construction during the building of their Park System (Brookline, Mass.). Superintendent Streets, Winchester, Mass., two (2) years. In office Ernest W. Bowditch, C. E., Boston, during portion of the building of Tuxedo Park (6,000 acres), N. Y. In Engineer Department Boston & Maine R. R. two (2) years; on railroad engineering and construction in Florida three (3) years. During 1904 C. E. and Supt. Con. in Q. M. Department, U. S. A., Boston, Mass. Has been associated with Warren H. Manning, Landscape Designer, of Boston, Mass., for five (5) years. *Home address, 20 George Street, Somerville, Mass. Present address, Jamestown Exposition Company, Pine Beach, Va.*

FULLER, Howard N., Comptroller of the City of Albany, N. Y. Born at New Baltimore, N. Y., October 29, 1853, son of William and Lydia A. (Swezey); graduated at Rutgers College in 1874; married. President Albany County McKinley League 1896; President Unconditional Republican Club three terms; Alderman, 1889-1890; Republican candidate for Mayor 1890; Commissioner of Education 1891; elected Comptroller 1901 by 1,875 plurality, in 1903 by 4,251 plurality, in 1905 by 8,278 plurality; member Fort Orange Club, Sons of the Revolution; trustee Rutgers College; trustee Home Savings Bank, Albany; trustee First Reformed Church, Albany; A. M., Rutgers, 1877. Author Rutgers College's famous song, "On the Banks of the Old Raritan." *Residence, 144 State Street, Albany, N. Y. Summer residence, North Hero, Vermont.*

HARK, Walter Perley, First Assistant Attorney-General of Massachusetts. Born at Manchester, N. H., May 9, 1867; educated at the public schools, Brown University and Harvard Law School; 1891 was admitted to bar. In 1894 came to Fitchburg, and in 1898 became law partner of Charles F. Baker. Was City Attorney for five years, has been a member of the Republican State Committee and was chosen a Roosevelt Presidential Elector in 1904. Been active in city affairs. *Residence, Fitchburg, Mass.*

KIRKENDALL, Fred C. Mayor of Wilkes-Barre, Pa., born at Wilkes-Barre, August 10, 1871. Son of Ira M. Kirkendall, the first Mayor of Wilkes-Barre, still living. Educated at public schools; graduated at Lafayette College, Easton, Pa., 1894. Associated with his father in wholesale grocery business as the firm of Kirkendall & Son. Elected County Treasurer of Luzerne County at age of 27. Married Eleanor C. Gearhart, of Danville, Pa. Has been County Chairman and City Chairman of Democratic party; member of all Masonic bodies, and Westmoreland Club; Director of Second National Bank, Penn Tobacco Co., Ottawa Gas & Light Co., and Boys' Industrial Association; President of Wilkes-Barre Driving Park Association, the Leader Publishing Co., and was editor of Leader, evening, daily, until elected Mayor. *Residence, Wilkes-Barre, Pa.*

TRAUTWINE, John C. Jr., born in Philadelphia March 17, 1850; attended private schools in Philadelphia. Consulting Engineer; editor of Trautwine's "Civil Engineer's Pocket-Book," "Railroad Curves," and "Excavations and Embankments." Associate member American Society of Civil Engineers and Institute of Civil Engineers, London. Member Franklin Institute, Engineers' Club of Philadelphia, American Water Works Association and New England Water Works Association; 1895-1899 Chief of Bureau of Water, Philadelphia, Pa. *Address, 257 South Fourth Street, Philadelphia, Pa.*

WICKES, Colonel Joseph Lee, Asso. M. Am. Soc. C. E. Commissioner of Street Cleaning, Baltimore, Md., since 1903, had charge of clearing away and final disposition of one million cubic yards of debris after great Baltimore fire. Born Chestertown, Md., December 3, 1863, son of Judge Pere L. Wickes and Henrietta C. (Welsh), educated at private schools and United States Naval Academy, took special course in civil engineering. With Pennsylvania Railroad on construction and maintenance work for fifteen years. Principal Assistant Engineer, Panama Railroad on Isthmus for two years. Assistant Engineer City Engineer's Department, Baltimore, Md. Colonel on staff of the Governor of Maryland

JOHNSTON, H. W. Mayor of Apalachicola, Fla., was born in Bainbridge, Ga., May 28, 1860. He is a printer by trade and editor by profession. In 1881 he moved to Apalachicola, Fla., and established *The Tribune*, which was merged into *The Times* in 1886. He was a member of the Florida legislature of 1889 and declined a second term. Has been mayor of Apalachicola since 1891, with the exception of two years, when he declined to enter the race for the Mayoralty. *Residence, Apalachicola, Fla.*

CHASE, Harvey S., expert municipal accountant; introduced first practical applications of "uniform" municipal reports and accounts. Born at Portsmouth, N. H., June 18, 1861. Graduated as mechanical engineer Massachusetts Institute of Technology, 1883. Practical work in Manchester and Amoskeag Cotton Mills, Manchester, N. H., two years; engineer, afterward treasurer, of gas works and water works at Great Falls, N. H., six years; treasurer and auditor of corporations in New York City, six years; public accountant and auditor, Boston, nine years; president of the Incorporated Public Accountants of Massachusetts; member of Executive Committee of the American Association of Public Accountants; treasurer of the Economic Club of Boston, Member of the Economic Association; Member American Society of Mechanical Engineers; American Institute of Electrical Engineers; American Institute of Mining Engineers; City Club of New York; Technology Club of Boston; member of Executive Committee National Municipal League; member Commission of One Hundred on Municipal Ownership, National Civic Federation; Chairman Committee on Standard Reports for Municipal Industries and Public Service Corporations, American Association. Made first application of "uniform" schedules in the City of Newton Report for 1900; was consulting expert on reorganization of City of Chicago accounts, 1901; consulting expert uniform schedules for all cities in Ohio, 1902; expert for Mayor of Boston, 1902; consulting expert Secretary of State, New York, 1903; consulting expert on Minneapolis accounts, 1904; applied "uniform" schedules in Brookline, Cambridge, Bridgewater, Pawtucket, etc., etc., 1904, 1905, 1906; address, books, etc.; March, 1900, "Depreciation in Gas Works;" February 11, 1903, "The Work of the Bureau for Uniform Municipal Reporting, Auditing, and Accounting in the State of Ohio;" March 23, 1903, "Modern Business Methods Applied to City's Financial Affairs. Uniform Municipal Reports and Accounts;" April 23, 1903, "Progress of Uniform Municipal Accounting in Ohio;" May 7, 1903, "Regeneration of Municipal Governments and the Part to Be Played Therein by Uniform and Comparative Accounts and Reports;" December 19, 1903, "The Recent Development in the United States of the Uniform System for Comparative Municipal Reports;" April 29, 1904, "Practical Applications of the Schedules for Uniform Municipal Reports and Accounts;" September 26, 1904, address before Congress of Accountants at St. Louis, on "A Brief History of the Movement toward Uniform Municipal Reports and Accounts in the United States;" February 2, 1906, "Municipal Revenues and Expenditures in Relation to the Control of Quasi-Public Enterprise;" February 14, 1906, "Municipal Industries and Public Service Corporations—Uniform Schedules for Standard and Comparative Reports;" April 24, 1906, "Standard and Uniform Reports for Public Utilities, Both Municipally Operated and Privately Operated." *Address, 27 State Street, Boston, Mass.*

A COMPENDIUM

Current Topics of Municipal Interest as Treated by Contemporaries—Opinions on City Affairs

A Point Ignored.—The lenders of money to cities—the buyers of municipal bonds—say: "What do you offer for security?" "How much private property is there in your city and how much can you tax these private owners in order to pay the interest on our money, and ultimately pay us back the principal?" If the private property is large and the city borrows little, the lenders of money charge low rates of interest. But does anyone with the least practical knowledge imagine for one instant that lenders of money are going to take low-interest bearing bonds from a municipality if that municipality exceeds conservative borrowing, if its undertakings have anything speculative about them? What reason is there for believing that people with money will be satisfied with any lower return from cities than from private enterprises where the security is the same? If the city pledges other security, it is blinding itself as to the rates it pays on the particular enterprise it has undertaken, because it will pay higher for everything else. Municipalities have not accumulated wealth which they can advance for enterprises—they can only pledge the taxes that they are to collect from private property—they cannot pledge the private property itself. Every time they raise the taxes they increase the attraction of other places, and the first suspicion of municipal bankruptcy would send their interest rates skyward and their industries to other places.

The
Inter-
Nation

Firemen and Fire Water.—"The People of Reading, Pa., have suspected that some members of the Fire Department are not strictly temperate in their habits, and have gone so far as to assert that in case of a serious conflagration it would not do to depend upon them to save their homes. It is asserted that clubhouses are maintained in close proximity to the engine-houses and that bad habits are formed in these resorts. Whether or not the city officials were believers in these accusations is not definitely known, but they at least decided to give the firemen a test a few nights since. An alarm was turned in. Did the firemen respond quickly? Well, if reports are to be depended upon, some of the laddies were half way to the scene of the supposed fire before the gong had sounded. Of course, there were plenty of incredulous persons who at once declared that the firemen had been "tipped off," but the boys strenuously deny it, and pronounce the test a very fair one. Not one of them was found to have taken a drink either before or after the alarm, and it is now a serious question whether the city of Reading wants to swap its volunteer department for a paid service."

The
Fireman's
Herald

The Business View of Water Waste.—The prevention of waste is a subject of such importance and such complexity in its practical details that it is a matter of some regret to observe any tendency to make it anything but a business problem. For example, the Society for the Prevention of Crime has collected information which may or may not indicate important leakage of water from the reservoirs at Central Park and Jerome Avenue in New York, as well as from other sources. These statements concerning leakage all refer to amounts that are insignificant in comparison with the total legitimate consumption in the city. In any great city there will always be places where waste can be found by those hunting for it, and people noticing such places will accomplish much more good by bringing them to the attention of the local water department than by making them the subject for a public outcry.

It should be understood that even in cities where the best theoretical methods are followed to restrict water waste, where the amount of water delivered is measured with reasonable accuracy, where all leakages in street mains are promptly stopped when detected, and practically all the service pipes are provided with a meter, the amount of water registered by the meters averages only about one-half of that pumped. It is on account of this experience in places which have adopted the theoretically best system of waterworks management, as well as on account of the results of the important investigations made in New York by Mr. Nicholas S. Hill, Jr., for the Board of Additional Water Supply, that a plea must be made for greater attention to the business aspects of waste prevention. It is far more complicated than anyone appreciates who has not become experienced with the detailed experience in waste prevention of the Superintendents of the Water Departments of numerous cities."

The
Engineering
Record

A Milwaukeean Creed.—"I believe that the office of Alderman and Supervisor should be non-partisan, and that all Council and Board committees should be organized strictly on a basis of integrity and fitness, without regard to party.

"I believe that every Alderman and Supervisor should represent the city and county at large, as well as his own particular ward, town or village; and that, while he may properly strive to advance local interests, yet in matters affecting the entire city or county, that the interests of the community as a whole should be placed above the separate interests of any of its parts.

"I believe that the city and county should have a strict and business-like system of accounting and auditing, and that appropriations should be kept within the revenues.

"I believe that every citizen has a right to full information as to the conduct of public business, and that executive sessions of committees should be avoided, unless absolutely required by the public interest.

"I believe in the principle of open competition for contracts for public business; and I also believe that the city and county has grown beyond the point where it should be regarded as necessary or desirable to limit competition for important contracts to the citizens thereof.

"I believe in the application of the merit system to the Civil Service and in the strict enforcement of the Civil Service laws."

The
Citizens'
Bulletin

Damages: Twenty-five Cents.—"In the action brought by Mr. John Cook, the City Engineer of Cape Town, (South Africa), for an alleged libel, it is difficult to reconcile the verdict for the plaintiff with the paltry damages awarded. A man in the position of the plaintiff is practically bound to incur the ill-will, from a business point of view, of a good many people; that is, if he performs his duties with impartiality and solely in the interests of the ratepayers. A good deal of latitude is permitted to those who object to his proceedings, and it is not often that his assailants can have a charge of libel brought clearly home, as it appears to have been in this case. The jury found that the defendant's letter was libelous, and awarded a shilling (twenty-five cents) damages; and the judge, remarking that there were no serious imputations upon the plaintiff, directed the costs to be paid by each party. The plaintiff doubtless regarded the imputations more seriously than did the jury or the judge, so much depends upon the point of view. There are many public officials we could name whose reputation stands so high that no reflections upon their integrity or their capability could harm them in the opinion of their fellow-citizens. If this is the view the Cape Town tribunal took of the allegations against the City Engineer, there is something to be said for the verdict."

Public
Health
Engineer

Utilities, Trade Notes and News

WESTRUMITE.—The Westrumite Company of America, 1117 Monadnock Building, Chicago, Ill., in pamphlet No. 101 calls attention to the importance of the use of Westrumite for sanitary reasons; the apparently increasing prevalence of dust constitutes a menace to health that is attracting the attention of physicians and sanitary engineers all over the world. Westrumite, a liquid of about the same weight as water, is used in an ordinary sprinkling cart. When first applied on a street two sprinklings of 10 per cent. or three of 7 per cent. are required. Afterwards 4 or 5 per cent. solutions may be used at such intervals as seem to be needed, varying from one to three weeks. Besides laying dust it is claimed that Westrumite preserves the road by preventing washing, and saves a large part of the cost of sprinkling. Use of this material has been adopted by Minneapolis, St. Paul, Denver, Colorado Springs, and New Orleans.

PORTABLE PAVING PLANTS.—Messrs. Hetherington & Berner, of Indianapolis, Ind., have had their manufacturing capacity taxed to its limit during the past winter and the present season. This company is constantly endeavoring to improve its products and has now a line of plants so varied in matters of capacity and cost that almost any kind of a demand may be readily met. It manufactures eight different kinds of asphalt paving plants, ranging in capacity from 500 square yards of two-inch pavement per day to 4,000 yards per day, ranging in cost from \$3,500 to \$16,000. The Two-car Hetherington Railway plant is well known. The One-car plant is, however, a new Richmond in the field.

NOVEL PAVING PROPOSITION.—F. O. Blake, 706 Home Trust Building, Pittsburgh, Pa., makes a new combination proposition designed to aid contractors with moderate capital to undertake asphalt paving contracts. He will supply a California asphalt, El Oso brand, claimed to be equal to the best quality of alcutez asphalt, together with a plant suited to the work on hand. The one-car plant can be set up and taken down at very little expense.

A BRICK PAVING SPECIALTY.—The Nash Road is formed of one or preferably two layers of perforated brick. Sand or cement may fill the perforations of the brick, affording a good foothold for horses, and in the foundation layer, if filled with cement, form a base equivalent to solid concrete.

PAVING BRICK.—The Shawmut Mining Company, Shawmut, Pa., have sent us a sample of their fire clay paving brick. The brick is handsome in color and general appearance. Samples of the material, about 2x4, would make good paper weights and thus form a permanent and attractive advertisement.

STREET CLEANING CAN.—The Knox & Wirt Company, 22 North Fourth street, Philadelphia, make a portable dust receiver that can be replaced when required with a water can for sprinkling. They have received single orders for as many as five thousand of these receptacles from a single city.

DIRECTORY OF MUNICIPAL AND ALLIED SOCIETIES

June 5-7.

NATIONAL ELECTRIC LIGHT ASSOCIATION.—ATLANTIC CITY, N. J.—W. C. L. Elgin, Secretary, 136 Liberty Street, New York.

June 6-7.

NEW YORK STATE ASSOCIATION OF FIRE CHIEFS.—CONVENTION, ELMIRA, N. Y.—H. R. Yates, Secretary, Schenectady, N. Y.

June 6-8.

MARYLAND STATE FIREMEN'S ASSOCIATION.—CONVENTION AND TOURNAMENT, WESTMINSTER, MD.

June 11-13.

ASSOCIATION OF AMERICAN PORTLAND CEMENT MANUFACTURERS.—QUARTERLY MEETING, ATLANTIC CITY, N. J.—Earle E. Bottomly, Assistant Secretary, Land Title Building, Philadelphia.

June 12-15.

MUNICIPAL LEAGUE OF INDIANA, MARION, IND.—John F. Taggart, Secretary, Richmond, Ind.

June 13-15.

LEAGUE OF GEORGIA MUNICIPALITIES.—ANNUAL CONVENTION, AUGUSTA, GA.—Bridges Smith, Secretary, Macon, Ga.

June 19-21.

HUDSON VALLEY FIREMEN'S ASSOCIATION.—CONVENTION AND CARNIVAL, RENSSELAER, NEW YORK.

June 20-23.

NATIONAL ASSOCIATION OF MASTER STEAM AND HOT WATER FITTERS.—ANNUAL CONVENTION, HOTEL ST. CHARLES, ATLANTIC CITY, N. J.—Henry B. Gomers, Secretary.

June 21-23.

AMERICAN SOCIETY FOR TESTING MATERIALS.—ANNUAL MEETING, ATLANTIC CITY, N. J.—Edgar Marburg, Secretary, University of Pennsylvania, Philadelphia.

June 26-29.

AMERICAN SOCIETY OF CIVIL ENGINEERS.—ANNUAL CONVENTION, THOUSAND ISLANDS, NEW YORK.—Charles Warren Hunt, Secretary, 220 West Fifty-seventh Street, New York.

June 26-28.

NATIONAL INTERSTATE TELEPHONE ASSOCIATION.—Auditorium, Hotel, Chicago, Ill.

June 27-29.

SMOKE INSPECTORS OF THE UNITED STATES AND CANADA.—FIRST ANNUAL CONVENTION, DETROIT, MICH.—John Fairgrieve, Smoke Inspector, Detroit, Chairman of Committee.

June 29-July 13.

AMERICAN LIBRARY ASSOCIATION.—TWENTY-EIGHTH CONFERENCE, NARRAGANSETT PIER, R. I.—J. I. Wyer, Jr., Secretary, 10½ Beacon street, Boston, Mass.

July 10-14.

AMERICAN WATER WORKS ASSOCIATION.—ANNUAL CONVENTION, BOSTON, MASS.—J. M. Diven, Secretary, 14 George Street, Charleston, S. C.

July 19-20.

AMERICAN SOCIETY OF HEATING AND VENTILATING ENGINEERS.—SEMI-ANNUAL MEETING, CHICAGO.—W. M. Mackay, Secretary.

August 15-17.

INTERNATIONAL ASSOCIATION OF MUNICIPAL ELECTRICIANS.—ANNUAL MEETING, NEW HAVEN, CONN.—Frank P. Foster, Secretary, Corning, N. Y.

September 26-28.

LEAGUE OF AMERICAN MUNICIPALITIES.—TENTH ANNUAL CONVENTION, CHICAGO.—John MacVicar, Secretary, Des Moines, Iowa.

October 15-20.

AMERICAN STREET AND INTERURBAN RAILWAY ASSOCIATION, COLUMBUS, OHIO.

DIARY OF COMING MUNICIPAL BOND OFFERINGS

DATE	TIME	AMOUNT	Denomina- tion.	Int. Rate	Matures Years	PLACE	STATE	PURPOSE	OFFICIAL AND ADDRESS
June 7.	2 p.m.	\$ 45,000.00	.....	4	.....	TICON'ROGA	N. Y....	School.....	Clerk.
" "	8 p.m.	20,000.00	.....	4	20-30	EDINBURG..	VA.....	Water.....	G. E. Irvin, Chm. Com.
" "	5 p.m.	108,450.00	.....	4 s.a.	34	RICHMOND..	VA.....	Refund.....	J. B. Wood, Chm. Com.
" 8.	8 p.m.	25,000.00	.....	5 s.a.	40	TEMPLE.....	TEXAS....	School.....	City Secretary.
" "	12 m.	18,000.00	.....	Bid.	.....	SAR'K LAKE.	N. Y....	Sewer.....	S. A. Miller, Clerk.
" "	12 m.	32,000.00	.....	Bid.	.....	" "	"	Water.....	S. A. Miller, Clerk.
" 9.	.....	20,000.00	.....	5 a	11	VIENNA.....	GA.....	Water.....	B. F. Forbes, Mayor.
" "	12 m.	14,000.00	.....	6 s.a.	10-20	C'R D'AL'NE	IDAHO....	School.....	J. A. Andrew, Clerk.
" 11.	.....	15,000.00	.....	5 a...	30	TERRA ALTA	W. VA....	Municipal....	F. N. Gandy, Record'r
" "	4 p.m.	50,000.00	1000	4 s.a.	10	LINCOLN....	NEB.....	Refunding...	B. C. Fox, Treas.
" "	.....	5,454.72	.....	4½ a.	1-10	WASEON....	OHIO....	Imp'ment....	Chas. J. Hodges, Cl'k.
" "	.....	20,000.00	500	4 a.	1-20	PAINESV'LLE.	"	St. Imp.....	F. Blackmore, Treas.
" "	7-30 p.m.	50,000.00	.....	5	1-20	YAZOO CITY.	MISS....	El. Ry.....	E. J. Poursine, Clerk.
" "	8 p.m.	5,000.00	.....	5	.....	COMFREY....	MINN....	Water.....	Recorder.
" "	12 m.	15,000.00	.....	5	30	TERRA ALTA	W. VA....	.....	F. N. Gandy, Rec.
" "	12 m.	20,000.00	.....	4 s.a.	1-20	PAINES'LLE.	OHIO....	St. Imp.....	E. J. Lynch, Aud.
" "	4 p.m.	50,000.00	.....	48 a.	10	LINCOLN....	NEB.....	Refund....	B. C. Fox, Treas.
" "	3 p.m.	60,000.00	.....	4 s.a.	20	OMAHA....	NEB.....	Fire.....	R. O. Fink, Treas.
" 12	.....	12,850.00	50 to 5	.....	1-10	DELAWARE..	"	Imp'ment....	F. B. King, Aud.
"		400							
" 14.	.....	10,000.00	.....	5	.....	EYOTA.....	MINN....	Water Works	W. J. Moulton, Eng.
" "	.....	5,000.00	.....	5 s.a.	20	PRAGUE....	NEB.....	Water.....	A. Kaspar, Clerk.
" "	12 m.	1,000,000.00	.....	3½	.....	PITTSBURG..	PA.....	Filtration....	A. M. Wagner, Aud.
" "	.....	5,000.00	.....	5 s.a.	30	ST. BERN'D.	OHIO....	Water & Lt...	Village Clerk.
" "	12 m.	150,000.00	.....	4 s.a.	30	N'W BRIT'N.	CONN....	.....	.....
" "	12 m.	50,000.00	.....	4 s.a.	17	SANDUSKY..	"	Harbor.....	A. M. Wagner, Aud.
" "	12 m.	17,000.00	.....	4 s.a.	10	"	"	Sewer.....	A. M. Wagner, Aud.
" 15.	.....	50,000.00	500	4 s.a.	.....	ST. BERN'RD	"	W'r & Light.	Geo. Shroder, Clerk.
" "	.....	100,000.00	.....	4	20	BURL'TON..	VT.....	Water Ref...	L. G. Grant, Treas.
" "	.....	39,000.00	.....	4	20	"	"	El. Lt.....	" " "
" "	.....	32,000.00	.....	3½	20	"	"	School.....	" " "
" "	.....	2,500.00	.....	4½ s.a.	10	MILAN.....	OHIO....	.....	F. A. Roberts, Clerk.
" "	12 m.	50,000.00	.....	4	.....	OMAHA....	NEB.....	Paving.....	F. E. Moores, Mayor.
" "	.....	20,000.00	.....	4 s.a.	20	IRONTON....	OHIO....	Rf. Water....	L. C. Grant, Treas.
" "	2 p.m.	15,000.00	.....	.....	.....	ALMER....	MICH....	Water.....	J. C. Spirey, Secy.
" "	6 p.m.	45,000.00	.....	Bid.	10-20	JOPLIN....	MO.....	Bldg.....	J. F. Livingston, Secy.
" "	8 p.m.	18,000.00	.....	5 a.	36	S.GL'NS F'L'S	N. Y....	School.....	Bd. Education.
" 16.	.....	13,300.00	.....	Bid.	16	MONT'S NO.	WASH....	.....	City Clerk.
" "	12 m.	11,000.00	.....	4 s.a.	10-20	BELPRE....	OHIO....	Building....	J. V. Athey, Clerk.
" 18.	12 m.	7,000.00	.....	4 s.a.	1-7	BEREA.....	"	School.....	Clerk Bd. Education.
" "	.....	71,595.00	.....	5 a.	1-12	YOUNGST'N..	"	Imp'ment....	N. J. Davis, City Aud.
" "	.....	4,400.00	200	4 s.a.	25	N'W R'M'ND.	"	Imp.....	C. T. Bainum, Clerk.
" 19.	.....	31,000.00	1000	4½ s.a.	.....	ASHTABULA.	"	School.....	C. E. Peck.
" "	3 p.m.	25,000.00	.....	4 a.	20	LEESBURG..	VA.....	Water.....	R. H. Tebbs.
" "	.....	3,200.00	.....	.....	.....	W. C'LTON..	OHIO....	Village.....	Elmer Selby, Clerk.
" 20.	12 m.	7,500.00	.....	4 s.a.	10	ALLIANCE...	"	Water.....	C. O. Silver, Aud.
" 21.	12 m.	25,000.00	.....	4 s.a.	25	NORWOOD...	"	Water.	W. E. Wichgar, Aud.
" "	.....	25,000.00	500	4 a.	.....	"	"	Water Works	" " "
Any date.	.....	15,000.00	.....	.....	.....	MOREHEAD..	MISS....	Water Works	M. G. Cumings, Clerk.
June 23.	2 p.m.	35,000.00	.....	5 s.a.	10-20	LEWISTOWN.	MON....	Water.....	H. L. De Kalb, Atty.
" 25.	.....	7,500.00	500	4 s.a.	30	WYOMING...	OHIO....	Water.....	W. A. Clark, Clerk.
" "	.....	10,000.00	500	5 s.a.	1-20	ASHLAND...	"	Sewer.....	A. S. Miller, Clerk.
" "	.....	7,174.00	350	4½ a.	.....	TROY.....	"	Ref.....	J. S. Moore, Clerk.
" "	.....	600.00	.....	5	5	CONNEAUT..	"	Sidewalk....	H. T. Culp, Aud.
" "	.....	8,000.00	.....	5 s.a.	.....	DALLAS....	"	Road Imp....	Findlay & Gallinger.
" "	12 m.	513,000.00	1000	.....	30	ROCKPORT..	"	Water.....	Clerk.
" 26.	.....	20,000.00	1000	5 s.a.	12	BUCYRUS...	"	Road.....	J. T. Smith, Aud.
" "	.....	1,500.00	500	5	2-6	ANDOVER...	"	Light.....	F. A. Woodward, Clerk.
" "	6 p.m.	25,000.00	1000	5 s.a.	1-25	VACAVILLE.	CAL.....	Sewer.....	E. W. Manual, T'n C'k.
" 28.	4 p.m.	720,500.00	.....	4	40	ST. JOHNS..	N. B....	Deb.....	H. E. Wardroper, Clk.
" "	.....	20,000.00	500	4 s.a.	11-21	HAMILTON..	OHIO....	School.....	Bd. Education.
July 1.	10 a.m	5,000.00	.....	5 s.a.	5-20	PRAGUE....	NEB.....	Water Works	Village Clerk.
" 2.	8 p.m.	9,500.00	.....	6	20	SUNNYSIDE..	WASH....	Water & Lt...	W. H. Turner, Clerk.
" "	.....	1,400.00	100	5 s.a.	5	GENOA....	OHIO....	Village.....	P. E. Manner.
" 6.	4 p.m.	35,000.00	.....	4	.....	VANCOUVER.	B. C.....	Imp.....	A. M. McEvoy, Clerk.

INCORPORATIONS

When our readers desire to correspond with any of the following companies, they should address the company itself or a director, incorporator or other official or partner by name to the address (if given) under such name. This will prevent letters being returned and marked "unknown."

ALABAMA

Tide Water Development Company, Birmingham; to build electric railways; capital, \$100,000. Incorporators: R. H. Little, D. J. Hancock, Robert J. Johnson and J. B. Cheney.

ARKANSAS

King River Electric Light and Power Company, Eureka Springs; capital, \$75,000. Incorporators: G. W. Matthews, C. M. Barnes and A. E. Barnes.

CONNECTICUT

Shore Line Electric Railway Company, New Haven. Incorporators: Moses Joy, president; Wm. S. Pardee, vice-president; A. W. Sperry, secretary and treasurer.

DELAWARE

American Concrete Butt Company, Philadelphia; to manufacture butt attachments for telegraph and telephone poles; capital, \$2,000,000. Incorporators: Cortland D. Cramp, Frank R. Shattuck, Philadelphia; Leek Forsyth, Battle Creek, Mich.; John Grant, Detroit, Mich.

Morgan Brick Company, Norristown, Pa.; to manufacture bricks, tiling, etc.; capital, \$100,000.

Pressed Steel Package Company, Pittsburgh; to manufacture, sell and deal in pressed steel packages; capital, \$300,000. Incorporators: David Speer, Joseph Speer, Arthur Speer, F. Bennett, all of Pittsburg.

Smoke & Syphon Co., Philadelphia; to manufacture and deal in smoke consumers and utilizers; capital, \$1,000,000. Incorporators: Ira H. Karper, Robert W. Kilpatrick, Philadelphia; A. P. Stevenson, Wilmington, Del.

IDAHO

The Idaho Gas Company, Lewiston; capital, \$200,000.

ILLINOIS

National Improvement and Construction Company, Cairo; capital, \$2,500. Incorporators: Peter Arlund, James H. Mulcahey, S. H. Yates.

INDIANA

The Coal Creek Power Company, Henryetta, Ind.; capital, \$10,000. Incorporators: W. N. Martin, William Stodselburg and others.

Flora Water Company, Flora; capital, \$25,000. Incorporators: Edward Kitzmiller, Charles G. Sines, Charles Voorhees and others.

Indianapolis, Decatur and Ohio Traction Company, Decatur; capital, \$10,000. Incorporators: H. R. Moltz and J. B. Holthouse, of Decatur; J. R. Tudor, of Van Wert, Ohio, and S. N. Young, G. A. Gessner and T. Y. Todd, of Toledo.

Indiana Cut Stone Company, Bedford; capital, \$75,000. Directors: Frederick D. Norton, Clinton S. Norton and Robert Reed.

INDIAN TERRITORY

The Tulsa Electric Railway Company, Tulsa; capital, \$10,000. Incorporators: Lyman F. Parker and others.

KANSAS

Kansas Traction Company, Oswego; to build an electric road from Cherryvale to Columbus. Incorporators: S. B. Milleh, president, and J. D. Morley, secretary, both of Oswego; C. O. Wright, Cherryvale.

MAINE

Greenlaw Manufacturing Company; making and sale of railway cars; capital, \$500,000. President, R. B. Edes, Newton, Mass.; treasurer, A. E. Knowlton, Boston, Mass.; clerk, H. S. Trickey, Malden, Mass.

Leffler Electric System, Portland; capital, \$5,000,000. Incorporators: Millard W. Baldwin, president, and others.

Middlesex Brick, Stone and Tile Company; making and dealing in stone, brick, tile, etc.; capital, \$250,000. President and treasurer, A. R. Torrey, Boston, Mass.; clerk, G. F. Gould, Portland, Me.

Penobscot Tile and Pottery Company; making and sale of brick, tile, etc. President, H. B. Blach, Everett, Mass.; treasurer, W. S. Lee; clerk, C. L. Andrews, Augusta, Me.

Potomac Granite Company; quarrying and dealing in granite and other stones; capital, \$500,000. President, G. E. Hadlock; treasurer, W. S. Lee; clerk, C. L. Andrews, Augusta, Me.

MASSACHUSETTS
Chambers Wood Stain Company (Incorporated); manufacture, buy, sell and deal in

and with wood stains; capital, \$10,000. President, Benjamin B. Baker; treasurer and clerk, Henry S. Baldwin, Boston.

New England Audit Company; to open, take charge of books of account; capital, \$10,000. President and treasurer, Frederick J. Hillman, 327 State St., Springfield, Mass.; clerk, Henry S. Summer, 25 Beechwood Ave., Springfield, Mass.

MINNESOTA

St. Cloud Electric Power Company, St. Cloud; capital, \$100,000. Incorporators: C. J. Jacobson, E. J. Wood and others.

MISSOURI

Wednesday Club Building Co., St. Louis; capital, \$40,000. Incorporators: Lillian T. Bixby, 3,815 shares; Florence Lewis Atkinson, Annie F. Durant, Martha E. Fischel, Clara Taussig and Emma Greeley Tredway, 10 each; Emilie Ivens Meier and Mary H. Semple, 50 each; Elizabeth C. Crunden, 25; Lillie R. Ernest and Mina W. Shapleigh, 5 each.

MONTANA

Bear Creek Water Company, Red Lodge; capital, \$60,000.

Belgrade Water Company, Belgrade; capital, \$50,000. Incorporators: Charles Vanderhook and others.

NEBRASKA

The Midway Gas, Heat, Light and Power Company, Kearney; capital, \$50,000. Incorporators: Horace Jones, H. D. Watson, W. S. Clapp and others.

NEW JERSEY

Coatesville Concrete Construction Company, 127 Market St., Camden, N. J.; to manufacture brick, concrete and concrete blocks, etc.; contracting, real estate; capital, \$150,000. Incorporators: Amasa B. Walker, A. Grigg, Philadelphia; William B. McDonald, Camden, N. J.

The Consolidated Public Utilities Corporation, 14 South Tennessee Ave., Atlantic City, N. J.; goods, wares, merchandise, real estate, etc.; capital, \$125,000. Incorporators: Oliver T. Rogers, Richard H. Robertson, N. A. Rupp, Blackstone Building, Atlantic City, N. J.

Morehead and Straight Creek Railroad Co., Courthouse, Trenton, N. J.; railroad business in Kentucky and all other States but New Jersey; capital, \$500,000. Incorporators: Henry E. Clark, Glen Campbell, Pa.; John W. McCullough, Friendville, Md.; Edward B. Carr and John R. K. Scott, Philadelphia; Dr. Henry D. Heller, Hellertown, Pa.; Cyrus D. Hottenstein, Sunbury, Pa.; J. Hiram Bradley and Garn H. Elliott, Morehead, Ky.

North Newark Concrete Block Company, Grafton Ave., Newark, N. J.; general construction business, to manufacture concrete cement and other blocks; capital, \$25,000. Incorporators: Gustave B. Janson and Elizabeth F. Qualey, as above; August A. Krieb, Maple Place, Nutley, N. J.

Orleans Gravel and Sand Company, 119 Market St., Camden, N. J.; to dredge for sand, shells and other paying and building material; contracting, freighting and towing; capital, \$25,000. Incorporators: Andrew J. and Michael J. Maloney, James P. Fogarty, all as above.

Pascoe Tubercular Sanitarium Company, 147 East State St., Trenton, N. J.; to maintain institutions for the study, care and cure of tuberculosis; chemists, druggists; capital, \$150,000. Incorporators: J. K. Neagley, A. Nuernberg, F. L. Kern, all as above.

Republic Wood Pavement Company, 1 Exchange Place, Jersey City; general paving business; capital, \$100,000. Incorporators: Francis V. Many, 32 Chestnut St., Red Bank, N. J.; Elmer H. Cohic, 15 Exchange Place, Jersey City; Frank G. Turner, as above.

Simon & Crawbuck Company, 15 Exchange Place, Jersey City; to manufacture bricks and building materials, electric motors, dynamos and other electrical machinery; capital, \$50,000. Incorporators: Philip and Helen Simon, 220 Washington St.; John D. Crawbuck, 341 Montgomery St., all of Jersey City.

Southern Spruce Company, 15 Exchange Place, Jersey City; lumber business; capital, \$1,000,000. Incorporators: E. H. Hatch, J. E. Slaymaker, George W. Lea, all as above.

P. A. Stewart Company, 300 Essex St., Gloucester City, N. J.; builders, contractors, decorators, etc.; capital, \$100,000. Incorporators: Patrick A. Stewart, as above; John M. Kelley, 1403 Kenwood Ave.; Frank S. Warren, 527 Penn St., both of Camden, N. J.

West Side Real Estate Company of Newark, N. J., 20 Bruce St., Newark, N. J.; real estate, builders, contractors, etc.; capital, \$25,000. Incorporators: Samuel Goldberg, Max Block, Samuel Herman, Newark, N. J.; Max Elsberg, Jersey City.

NEW YORK

Henry Phipps Estate; real estate, warehouse and wharves; capital, \$500,000. Incorporators: Henry and John S. Phipps, George E. Gordon, all of 787 Fifth Ave., New York.

James Ackroyd & Sons; manufacture galvanized iron and copper cornices, etc.; capital,

\$25,000. Incorporators: James Ackroyd, Hildreth J. Ackroyd, Austin W. Ackroyd, Albany, N. Y.

The Aqualite Fireproofing Paint Company; painters; manufacture paints, etc.; capital, \$10,000. Incorporators: Edward H. Neary, Jr., 31 Nassau St.; F. de C. Sullivan, 235 West 75th St.; E. N. Williams, 112 West 72d St., New York.

Binney-Godfrey Company; general contractors, etc.; capital, \$25,000. Incorporators: William J. Binney, Frederick Godfrey, John T. Pierson, all of Kent Ave. and Rodney St., Brooklyn.

Garden City Securities Company; to construct buildings, hotels, docks, etc.; capital, \$300,000. Incorporators: George J. Smith, Kingston, N. Y.; Ernestus Gulick, 350 Fulton Street, Brooklyn; William H. English, 60 Murray street, New York.

Godwin Realty Company; general contracting; capital, \$10,000. Incorporators: Joseph Godwin, 1342 Fifty-first street, Brooklyn, N. Y.; Harry La Vergne Warner, 59 West One Hundred and Fifth street, New York; Ray W. Kellogg, 1449 Fifty-first street, Brooklyn, N. Y.; Frank W. Goodwin, 213 West Thirteenth street; Albert J. Reids, 5 West One Hundred and Thirty-seventh street, N. Y.

Harlem Patrol Company; special officers; capital, \$500. Incorporators: Max Meyers, 152 Orchard street; William Braune, 405 East Fifth street; Henry Teitel, 132 Ludlow street, all of New York, and others.

H. C. Harrower Company; architectural iron and steel work; capital, \$20,000. Incorporators: H. C., George H. and Sarah B. Harrower, Buffalo, N. Y.

Hopkins, Richter & Co.; building and contracting; capital, \$1,000. Incorporators: Joseph Hopkins, 11 North First street, Jamaica, N. Y.; Frederick Richter, 144 Sheffield Avenue, Brooklyn; Julius Blumberg, Queens, L. I.

Kent Building Company; real estate, building; capital, \$300,000. Incorporators: John D. Boyd, Bayonne, N. J.; Walter Cook, Jr., 2 Wall street; Edward R. Peet, 111 West Eleventh street, both of New York; Gustavus T. Kirby and L. Hollingsworth Wood, Mount Kiscom, N. Y.

Lawler Bros. Construction Company; to construct railroads, bridges, etc.; capital, \$10,000. Incorporators: William J. Lawler, Grand Union Hotel, New York; John S. Lawler, Bartow, N. Y.; Burton M. Lawler, Charlestown, Mass.

National Conventions Association; to contract for halls for conventions, etc.; capital, \$20,000. Incorporators: Herbert S. Bradfield, 170 Broadway; George A. Busch, 503 Fifth avenue, both of New York; W. H. Slengerland, Hackensack, N. J.

O'Connell Piper Company; manufacture mantels, fireplaces, terra cotta, etc.; capital, \$350,000. Incorporators: Samuel M. Piper, Edmund B. O'Connell, 929 East One Hundred and Fifty-first street, New York; Ruby S. Piper, 336 West End Avenue, New York.

Peter Cunneen & Company; plumbing and heating work; capital, \$25,000. Incorporators: Peter Cunneen, Daniel Cunneen, James Haggerty, Alexander Magee, John Tynan, New Rochelle, N. Y.

Saratoga Springs-New York Realty Company; real estate; building; capital, \$50,000. Incorporators: John Wagman, William W. Boyd, Mabel L. Haskins, all of Saratoga Springs, N. Y.

State Construction Company; real estate, building, etc.; capital, \$25,000. Incorporators: K. P. Walker, 5 East Forty-second street; John K. Turton, 1133 Broadway; Samuel B. Howard, 125 Broadway, New York.

NORTH CAROLINA

North Carolina Electric Company, High Point; capital, \$11,000,000.

OHIO

The Cleveland, Brooklyn and Elyria Railroad Company, Cleveland; capital, \$10,000. Incorporators: B. E. Ottman, L. J. Weadock, W. E. Elliott, R. J. Kalina and others.

Oberlin Telegraph Company, Oberlin; capital, \$50,000. Incorporators: V. W. Johnstown, E. P. Johnstown, E. R. Graham, C. K. Whitney, L. G. Durand.

The Kendallville & Goshen Traction Company, Kendallville; capital, \$20,000. Incorporators: Frank L. Washelmer, F. B. Berkers, Arthur B. Shephard.

PENNSYLVANIA

The Shenango and Mahoning Valley Light and Power Company, New Castle, Pa.; to take over the New Castle, Warren, Youngstown and Nile railway system and to build a road from Garrettsville to Cleveland; capital, \$10,000,000.

TEXAS

Houston Suburban Company, of Houston; \$10,000. Incorporators: W. J. Howard, J. M. Coleman and N. C. Abbott.

Union Central Light and Ice Company, Hubbard City; capital, \$25,000. Incorporators: N. A. Bach, J. E. Weller and others.

PATENT CLAIMS

820,946.—LIFTER FOR MOLDED BUILDING-BLOCKS. Andrew M. Balzer, Des Moines, Iowa, assignor to Miracle Pressed Stone Company, Sioux Falls, S. D., a Corporation of South Dakota. Serial No. 266,762.

In a device for the purpose indicated, in combination with a fulcrum-plate, a pair of levers fulcrumed on such plate projecting downwardly from their fulcrums, having arms extending in opposite directions in the plane of movement of the respective levers about their fulcrums; a third lever fulcrumed on the plate for movement transversely with respect to said arms and extending under the same, and means by which the downwardly-extending levers grasp the block to be lifted.

820,970.—METAL PILING. James J. Harold, Jersey City, N. J., assignor, by mesne assignments, to Emma Harold, Jersey City, N. J. Serial No. 237,871.

In metal piling, interlocking members and flanged beams, said interlocking members provided with channels and flat surfaces, said flat surfaces of said members fastened together and said channels adapted to engage and retain the flanges of said beams.

821,031.—CONCRETE-BRICK MACHINE. George W. Dy Arman, Indianapolis, Ind., assignor of one-half to John Whitaker, Middleport, Ohio. Serial No. 267,501.

A concrete-brick machine including a base, a plurality of upright plates mounted upon the base, a slotted combined mold-bottom and carrier, a mold-front and a mold-back having each a recess in the top thereof opposite a space between two of the upright plates, and a clamp for the mold-front and the mold-back fitting in the slots and insertible between said two of the upright plates.

821,037.—WALL FOR DAMS, BARRIERS, PROTECTION-WALLS, RESERVOIR-WALLS, AND THE LIKE. François Hennebique, Paris, France. Serial No. 142,400.

In dams, guard-walls and reservoirs proper, the combination of continuous thin and water-tight cylindrical walls concave toward upstream, said walls consisting of cement strengthened with a metallic framework, resting on and attached to piers of strengthened beton, buttressed by platforms of strengthened cement, substantially as described.

821,050.—SEWAGE-EJECTOR. Frederick Meyers, Chicago, Ill., and Charles T. Hildebrandt, Dayton, Ohio, assignors to The Dayton Hydraulic Machinery Co., Dayton, Ohio, a Corporation of Ohio. Serial No. 282,227.

In a sewage-ejector, a catch-basin, a suction-pump connected with the bottom of said basin, a suction-pump connected with the opposite side of said basin at an elevation, and a spraying device connected with the discharge-pipe of the lower pump and adapted to inject water into the basin in a direction toward the inlet to the elevated pump, whereby means are provided for reducing the contents of the basin, and for removing the surface matter from the contents of said basin, substantially as specified.

821,098.—AUTOMATIC FIRE-ALARM. John W. Griffin, Pawtucket, R. I. Serial No. 254,739.

In an automatic fire-alarm, a base having upon one face a longitudinal channel, and upon the opposite face having longitudinal and transverse intersecting channels, binding-posts, nuts and circuit-wires connected in the last-named channels, a tubular section of insulating material in the first-mentioned channel, caps on said section having feet held by said binding-posts, a fixed contact within said tubular section, a movable contact within said section, and fusible means for normally holding said contacts separated.

821,152.—MEANS TO SPRINKLE CRUDE OIL ON DUSTY ROADS. John F. Blunt, Los Angeles, Cal. Serial No. 258,722.

Means for sprinkling crude oil on dusty roads comprising in combination a portable oil-tank, a discharge-pipe leading therefrom; a sprinkling-cylinder carrying an apron and having connecting-nipples and flexible connection solely connecting the discharge-pipe with the nipples.

821,160.—CONTROLLER FOR DISTRIBUTION OF FLUID IN CITIES. Frank J. Foveaux, Alameda, Cal., assignor to Mutual Gas and Engineering Company, a Corporation of California. Serial No. 248,461.

In an apparatus of the character described, the combination of a cylindrical valve-casing having ways, a stem arranged axially of the casing, arms secured upon said stem, a yoke-shaped valve-gate having sector-shaped holes in the arms of said yoke, said holes surrounding the valve-stem and the arms secured thereon, the middle portion of the yoke being cylindrical in form to move in contact with the cylindrical wall of the casing, the face of the gate having an opening therein, a relief-valve in said opening, means operated by the movement of the stem for withdrawing said relief-valve, the arms on the stem in their further movement being adapted to come into contact with the arms of the yoke-shaped gate to actuate the same, substantially as described.

821,191.—FIRE-HYDRANT. Robert M. Pringle, St. Louis, Mo., assignor to Corey Estate Company, St. Louis, Mo., a Corporation of Missouri. Serial No. 269,045.

In a fire-hydrant, the combination with a stand-pipe and its valve-seat, of a main valve, a valve-operating rod provided with oppositely-pitched threaded portions, nuts co-operating with said threaded portions, links pivotally connected to said nuts and to said main valve, and an independent connection between said links whereby said links are caused to approach each other to nearly parallelism, when the main valve is seated; substantially as described.

821,241.—GARBAGE-CAN. Isaac Hirsohn, New York, N. Y. Serial No. 258,873.

A garbage-can comprising a body, a longitudinally-disposed reinforcing-strip attached to the sides of said body and extending across the bottom thereof, the ends of said strip being disposed adjacent the upper edge of the body and extending outwardly at approximately right angles thereto, one of said ends being provided with a bead and the other having an aperture therein, a cover

fitting over said body, and a cross-strip upon the upper face of said cover extending outwardly at its ends at approximately right angles to the sides of the cover, one end of said cross-strip being pierced with an aperture registering with the aperture in said reinforcing-strip, and the other end being provided with a hook embracing said bead.

821,268.—SMOKE-CONSUMING FURNACE. Robert L. Walker, Brooklyn, N. Y. Serial No. 89,647.

In a locomotive-furnace, a fire-box provided with a centrally-arranged vertical water-leg, a combustion-arch at the front end of the fire-box, there being a passage around the front end of the water-leg under said arch, a movable water-damper revolvably mounted above said water-leg to close the passage on either side of said water-leg and behind said arch, said damper being formed with a sinuous tapering passage gradually increasing in cross-section from its inlet to its outlet, means to cause a circulation of water through said damper, a damper-sector secured to the shaft of said damper, a cylinder, a rack-frame actuated by said cylinder to operate said damper-sector, a controller to admit steam to said cylinder to operate said damper, said controller having a lower steam-inlet, opposite cylinder-pipes and an exhaust-pipe on the same level, a hollow tapered valve formed with a diagonal diaphragm, there being two exhaust-ports above said diaphragm and two steam-ports below said diaphragm to coat with said cylinder-pipes and said exhaust-pipe, a blast-pipe to cause an induced draft in said furnace, an automatic blast-valve to be operated by the throttle of said engine to increase the draft of said furnace when the engine is not running.

821,277.—MEANS FOR CONSTRUCTING CONCRETE WALLS. Charles H. Bellars, Lyndhurst, N. J. Serial No. 297,401.

In an apparatus for constructing concrete walls, a series of moldboards for the exterior face of a wall, stays for each of said series, located opposite each other in pairs, bolts extending through the lower portions of each pair of stays, through the lowermost board of each series and said wall, bolts extending through the upper portions of each pair of stays, and through the uppermost board of each series, and means carried by said bolts for engaging said wall when embedded therein, and means for disengaging said bolts.

821,323.—APPARATUS FOR DISTILLING COALS AND OTHER HYDROCARBONACEOUS SUBSTANCES. Henry Wurtz, Newark, N. J., assignor to American Chemical Education Company, a Corporation. Serial No. 255,354.

In an apparatus for distilling coals and other hydrocarbonaceous substances, spaced and staggered trays, for holding the substance to be distilled, inclosed in a compartment which is in communication on the one hand with a heat-flue from a fire-chamber adjoining the compartment, and on the other hand with an exhaust-pipe, and means for inducing currents of heated products of combustion to enter the compartment from the heat-flue and to zig-zag over the substance on the trays, and under and around the ends of the trays and to draw the products of combustion and distillation out of the compartment and into the exhaust-pipe, substantially as specified.

821,346.—CAR-FENDER. Harry Ekrem, San Pedro, Cal. Serial No. 285,318.

The combination with a fender which is yieldably supported in an elevated position, of a trip member located in front of the fender and having a toggle connection therewith to positively depress the fender when the trip is moved rearwardly.

821,360.—FILTER. Frank B. Hinkson, New Castle, Pa., assignor to The Electric Liquid Purifying and Filtering Company, Pittsburgh, Pa. Serial No. 258,602.

In a filter, the combination with a casing of electrically-conducting material and having water inlet and outlet ports, of a perforated shell of electrically-conducting material located within said casing, an electric circuit including said casing and shell, and filtering material within said shell.

821,368.—CONSTRUCTION OF WALLS, FLOORS, ETC. Edmond Molloy, Philadelphia, Pa. Serial No. 159,592.

In a structure of the class described, suitable runners and tie-pieces and members sleeved on the runners and co-operating with the tie-pieces, whereby tension may be placed upon said runners.

821,416.—AUTOMATIC VENTILATING APPARATUS. James H. Hummel, Mount Vernon, N. Y. Serial No. 254,116.

In an apparatus of the class described in combination, an exhaust-fan, an electric motor therefor, automatically-operated circuit-closers for the motor-circuit, and a box for said fan having outwardly-swinging doors normally closed and arranged to be opened automatically by the air movement created by said fan.

821,421.—CRUSHING OR PULVERIZING APPARATUS. Walter Kitto, Barnes, London, England. Serial No. 239,837.

In a ball crushing-mill, the combination with a ball-raceway, a vertical driving-shaft extending through said raceway, and a bell-shaped ball-propeller driven by said shaft; of a resilient footstep for said shaft, a piston or platform vertically adjustable in said footstep and on which the lower end of said shaft directly rests, a spring interposed between said shaft and said piston, an adjustable buffer and means for adjusting the piston for the purpose specified.

821,453.—DEVICE FOR CUTTING AND SETTING BRICKS, ETC. Friedrich Beyer, Siegmar, Germany. Serial No. 195,832.

A device for cutting and setting bricks made by a bar-press, comprising in combination rollers at the end of the bar of clay being provided with means adapted to move the bricks forward in groups with gaps between the end of the clay-bar and after every group of two or more bricks said means consisting of wheels connected to the rollers and adapted to co-operate with a bar fitted on the frame of the press, substantially as described and for the purpose set forth.

821,513.—ATTACHMENT FOR GRADING-MACHINES. Warren E. Leighton, Lewiston, Me. Serial No. 270,537.

In a machine of the character described, the combination with tracing and following elements, of a connecting-bar attached to one of said elements, a plate connected to one of said elements, a lever pivoted upon said plate and pivotally connected to said rod for angular adjustment, and means for securing said lever upon said plate when adjusted.

LEGAL DIGEST— A Summary and Notes of RECENT DECISIONS

The Mayor Is Sustained

D. N. BROWNELL et al. vs. JOHN B. TRACY, MAYOR.—The Mayor is sustained in his findings whereby he removed two members of the license commission. After reviewing the evidence, the Judge is obliged to assume, until the contrary is proved, that the Mayor acted properly.—*Decision by Judge Bell, Superior Court, Fall River, Mass.*

Caveat Emptor Applies in Tax Sales

LINDNER vs. CITY OF NEW ORLEANS.—Held that a tax sale, in the absence of special legislation to the contrary, is subject to the rule caveat emptor, and the purchaser has no recourse in case of eviction against the municipality, under the authority of which the sale has been made, either for damages or for reimbursement of the price, his only remedy being to be found under Article 233 of the Constitution.—*Supreme Court, Louisiana.*

Lessee Collects Damages

LEVY et al. vs. MADDEN.—Where the defective condition of a brick wall in a leased storehouse rendered it dangerous to life and property and necessitated its reconstruction by the lessor, it was held that the lessee was entitled to recover actual and direct pecuniary loss occasioned by the work of reparation in addition to the reduction of rent provided for by article 2,700 of the Civil Code.—*Supreme Court, Louisiana.*

Procedure Under Municipal Acts

SUTER vs. THE BOROUGH OF WILMERDING.—A petition to quash proceedings for the appointment of viewers to determine the benefits and damages for the grading, paving and curbing of a borough street will be granted if the viewers were appointed under the act of May 24, 1878. The proper method of procedure is under the act May 16, 1891; the act of 1878 relating only to the change of grade or lines of any street or alley. The two acts stand together, and it is not only better practice, less expensive and less inconvenient to follow the procedure of the act of 1891, where the improvements are grading, paving and curbing, but it is, we think, in accordance with the true intent of the act.—*Common Pleas, Allegheny Co., Pa.*

Revoke Exemption from Taxation

ROCHESTER vs. ROCHESTER R. CO.—A legislative grant to an existing street railway company of exemption from taxation for improvement of the streets occupied by its tracks, not based upon any consideration, is held to be subject to revocation at the pleasure of the legislature.—*District Court, Rochester, N. Y.*

May Build Bridge

J. W. LEGORE vs. FREDERICK COUNTY COMMISSIONERS.—The commissioners have the right to build a bridge within one and one-half miles of the bridge of J. W. Legore.—*County Court, Frederick, Maryland.*

Use of Patented Materials

WARREN BROS. vs. INDIANAPOLIS, TOLEDO AND IOWA CITY.—Some recent decisions in the courts of Ohio, Indiana and Iowa have favored the contention of the Warren Brothers Co., that bitulithic pavement may be specified when a fixed price has been made for a portion of the paving mixture to all contractors alike. In Iowa City, a temporary injunction was dissolved in their favor where they had agreed to furnish bitulithic paving mixture to contractors. In Toledo, Ohio, Judge Wildman, in an opinion unanimously concurred in by the associate justices, in an appeal from the decision of a lower court decides in favor of a contract for paving a street with bitulithic pavement on the ground that it is wise that the people who have organized themselves into municipalities should avail themselves of every beneficial invention and should be permitted to go into the open market and buy whatever seems to be adapted to their use. In Indianapolis, where the Warren Bros. agreed to furnish Puritan brand cement together with the patent rights to lay bitulithic pavement, Judge McMasters gave a decision in favor of the Warren Bros. holding that the patentee may relinquish his right to use the patented article and place bidders on even terms by giving them the opportunity to purchase the article or process at its value.

BALTIMORE ASPHALT BLOCK PAVEMENTS

Editor MUNICIPAL JOURNAL AND ENGINEER,
Flatiron Building, New York City.

Sir:—Your issue of April 4, last, contains an article headed "Street Pavements in Baltimore," which states that "asphalt block pavements are so billowy as to produce a sensation only too reminiscent of seasickness in riding over it at speed, and truly an infliction on the city."

Will you grant me space in refutation of misstatements respecting a great and honestly conducted industry.

I embarked in the manufacture and laying of asphalt blocks in 1880, and, to the best of my ability, have devoted nearly 26 years of my life, which have since elapsed, to improving the character of these blocks and the manner in which pavements are laid with them, believing, as I did when I first saw them, and as I do now, that they constituted the ideal material for all pavements, except those subjected to the very heaviest of traffic and on very stiff grades.

Asphalt block pavements have been laid in Baltimore for twenty-five years, and more or less of them in every year during which any improved pavements were laid.

I assert that there are miles of good asphalt block pavement in Baltimore at this moment, and very little, if any, that can be fairly designated as "billowy," and particularly that the first asphalt block pavement *laid on a concrete foundation* in Baltimore—viz., that on Patterson Avenue from Fremont Avenue to Fulton Avenue (about 12,000 square yards), which was laid in the summer and fall of 1897, nine years ago—has been subjected to enormous traffic, including thousands of tons of large pipes for extension of waterworks and tens of thousands of tons of stone from quarries just beyond the western terminus of the avenue, besides the heavy general traffic, including that to and from Fulton Station, W. M. R. R. I also assert that no pavement of any kind, *ever laid* in Baltimore, has resisted such a traffic for such a length of time and remained in an equally good condition as this one, and it is in good condition to-day and not "billowy," and, so far as I know, has not cost the city one dollar for repairs. The only repairs (if they can be so called) have been the replacement of cuts for gas and water services.

At the end of the five years this pavement was guaranteed by the contractor; the City Engineer called for an expenditure of less than four dollars at one little place, which having been done, he accepted the work and the city paid over to the contractor the 10 per cent. of the cost of the pavement that had been retained by the city as an additional guarantee to the bond for maintenance for five years. All the other asphalt block pavements in Baltimore that were laid on concrete foundation are in good order, excepting alongside of railway tracks, where no pavement yet discovered will resist the very abnormal position and use for any great length of time.

In 1904 a vitrified pavement on Chase Street, between North Charles and St. Paul Streets, was in such a dilapidated state that the City Engineer decided it must be entirely removed and replaced by a new pavement. He had the complete option and prerogative of deciding what kind of pavement should be used. He decided in favor of asphalt blocks against all others, bought the blocks, and they were laid by city workmen under his direction and supervision, and I am happy to say that, in my humble judgment, no similar work was ever better done, nor is there a more perfect pavement, considering its cost and the time it has been used, than this same pavement upon which the splendid new hotel "Belvedere" fronts.

The asphalt block pavement has been steadily growing in favor since it was first devised, and many millions of them are being laid each year, whereas formerly the number could be counted in thousands per annum. Over twenty millions have been laid in Greater New York since 1889, of which more than half have been laid within five years, and there is a larger amount under contract at this time than at any previous time. There is no monopoly or trust in this industry. It is open to every one who can command capital and experience, and success depends entirely on the knowledge, the honesty, skill, and business capacity with which it is pursued.

I assert that a great majority of the engineers of our cities who have had reasonable experience in pavements believe and will say that asphalt blocks, when properly made and properly laid, constitute a really worthy pavement.

The Engineer Commissioners of the District of Columbia (always officers of the Engineer Corps of the United States Army), one after another, ever since the first asphalt block pavement was laid in Washington, over twenty-three years ago, have approved of it and recommended its use, and larger amounts of it have been laid from year to year, on the average, during that time.

In view of such facts as these, I respectfully submit that the statements about asphalt block pavements, given to the public in your columns, at least need some qualification.

WALTER S. WILKINSON.

ADVANCE AND WEEKLY CONTRACT NEWS

Relating to Municipal and Public Work—Street Improvements—Paving, Road Making, Cleaning and Sprinkling—Sewerage, Water Supply and Public Lighting—Fire Equipment and Supplies—Buildings, Bridges and Street Railways—Sanitation, Garbage and Waste Disposal—Police, Parks and Miscellaneous—Proposals and Awards

The Municipal Journal and Engineer wishes to obtain, at the earliest possible moment, advance and reliable information respecting all work projected. Any items sent us will be greatly appreciated. On request, copies containing such information will be mailed to you.

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STREET IMPROVEMENTS

Point Richmond, Cal.—Plans are under way to improve several streets.

Washington, D. C.—An appropriation of \$50,000 has been recommended for opening streets, by the Senate Committee.

Washington, D. C.—An appropriation of \$70,000 for work on streets and avenues has been recommended by the Senate Committee.

Atlanta, Ga.—Authority will be asked to issue \$250,000 street improvement bonds.

St. Joseph, Mich.—It is probable that several streets will be paved with brick.

Duluth, Minn.—Estimates are being prepared for paving Raleigh street.

Akron, O.—Vine street will be paved with brick; resolutions have been introduced to pave Spicer street and Brown street.

Columbus, O.—Plans will be prepared for paving West Broad street with stone block.

Fremont, O.—A bond issue of \$12,000 to pave Fourth street will be recommended.

Piqua, O.—It is recommended that Wayne avenue be paved with brick.—Jno. E. Anderson, Chairman, Street Committee.

Springfield, O.—The repair of many streets has been recommended, besides the extensive paving to be done.—W. H. Sievering, City Engineer.

Guthrie, Okla.—East Main avenue will be paved.—W. W. Miller, City Clerk.

Proposed Work.—**La Jolla, Cal.**—Bids will be advertised for grading Fifteenth street and B street.

Chicago, Ill.—Wentworth avenue from Root street to Garfield boulevard will be paved with brick.

Decatur, Ill.—Marritta street will be paved with brick.

Waukegan, Ill.—Several streets will be paved with brick.—Address, Board of Improvements.

Indianapolis, Ind.—Resolutions have been adopted for the following: Cement walks on North, Mabel, Twenty-sixth, Union streets, and Spann avenue, and paving in Twelfth, La Salle, Twenty-fourth, Arch and West streets, and Lexington and Talbot avenues.

Centerville, Iowa.—The Council has decided to lay two miles of brick paving.

Baltimore, Md.—An ordinance has been passed to pave Lexington street between Charles and Liberty streets.

Ashland, O.—Cottage street will be paved.

Bellefontaine, O.—Bids will shortly be received for 1,000 square yards of brick pavement, 5,500 linear feet of sandstone curbing, etc., at an estimated cost of \$15,000.—G. Smith, Clerk.

Bucyrus, O.—Bids will shortly be advertised for paving Prospect, Lucas and Charles streets with brick, requiring 25,000 square yards of paving.—C. A. Guiss, City Engineer.

Canton, O.—Garfield avenue, Bluff and Plain streets will be improved.

Cleveland, O.—It is proposed to pave, grade and drain Whitney avenue, East 108th street and East 106th street.—Peter Witt, City Clerk.

Delaware, O.—The Gantz Construction Company was the low bidder for paving Franklin street.

Greenville, O.—North Main street and East Third street will be paved.

Marietta, O.—Bids will be advertised for paving Fort street.

Monroeville, O.—The square at the intersection of Monroe and Main streets will be paved; material not decided upon.

Mt. Vernon, O.—City Engineer Cureton states that W. S. Bace of Newcomerstown was the lowest bidder for paving Hamtrack street.

Youngstown, O.—The following are the low bids received for paving: Chalmers street, \$9,149, Jas. McCarron; Bressott street, \$9,700, Anthony O'Horo.

Erie, Pa.—Several miles of concrete sidewalks will be laid.—Street Superintendent O'Hagon.

Leedsburg, S. C.—Bids will be received for constructing cement sidewalks at a cost of \$10,000.—J. W. Norman, Town Treasurer.

Aberdeen, S. D.—Cement sidewalks will be constructed on several streets.—A. M. Albridge, Mayor.

Memphis, Tenn.—Plans have been prepared to pave Poplar street at a cost of \$70,000.

Ft. Worth, Tex.—The residents of Hemphill street propose to expend \$25,000 for paving.

Suffolk, Va.—An appropriation of \$115,000 for paving streets has been made; material to be used, bitulithic and vitrified brick.

Baraboo, Wis.—Ordinances have been passed to pave Oak and, Third streets and Third avenue.—H. E. French, City Engineer.

Cranbrook, B. C., Canada.—Several miles of sidewalks will be constructed.

Calgary, Alta., Canada.—An expenditure of \$10,000 for macadam roads and granolithic sidewalks has been authorized.

St. Boniface, Man., Canada.—The Council will expend about \$30,680 for street improvement.—E. Goddard, Mayor.

Winnipeg, Man., Canada.—The city will spend about \$1,000,000 on street improvements, as follows: Asphalt pavement, \$500,000; macadam pavement, \$350,000; granolithic sidewalks, \$150,000; block pavement, \$90,000.—H. N. Ruttan, City Engineer.

Gravenhurst, Ont., Canada.—An ordinance has been passed to construct sidewalks at a cost of \$15,000.

Niagara-on-the-Lake, Ont., Can.—About \$15,000 will be spent on cement sidewalks.

Toronto, Ont., Canada.—Improvements will be made on many streets; about \$350,000 will be spent.

Toronto, Ont., Canada.—The Board of Public Works have decided to buy a \$20,000 stationary asphalt plant.

Contracts to Be Awarded.—**Mobile, Ala.**—Bids will be received, June 18, for the purchase of \$200,000, 4 per cent., 20-year road improvement bonds.—George E. Stone, Treasurer.

Morehead, Ala.—Bids will be received, June 6, for paving certain streets with macadam or vitrified brick.—Julian Kendrick, City Engineer.

Brazil, Ind.—Bids will be received, June 9, for constructing two gravel roads.

Spencer, Iowa.—Bids will be received, June 16, for constructing 20,000 lineal feet of cement sidewalks.—R. S. Taylor, City Clerk.

Great Falls, Mont.—Bids will be received, June 11, for repaving Central avenue from Park drive to Sixth street.—W. P. Wren, City Clerk.

New York, N. Y.—Bids will be received, June 12, for furnishing and delivering fire clay, brick, lime, pulverized slate, etc.—John McG. Woodbury, Commissioner of Street Cleaning.

New York, N. Y.—Bids will be received, June 12, for paving with Medina paving and asphalt blocks on a concrete foundation, East 165th street, and setting curb where necessary.—Louis F. Haffen, President, Borough of Bronx.

Marion, O.—Bids will be received, June 13, for paving portions of Columbus street with brick or block macadam.—Wm. Fries, Clerk.

Youngstown, O.—Bids will be received, June 11, for paving Elm street and for curbing and guttering Mahoning avenue.—G. T. Prosser, City Clerk.

Clarion, Pa.—Bids will be received, June 18, for grading and paving Main street with vitrified brick.—Borough Council.

Lewiston, Pa.—Bids will be received, June 18, for grading, paving and curbing Market street from County Bridge, Juniata street to Dorcas street, then to Chestnut street.

Patton, Pa.—Bids will be received, June 11, for paving portions of Magee, Beadle and Fourth avenues.—Edward S. Moore, Borough Secretary.

Bluefield, W. Va.—Bids will be received, June 12, for paving Bland street, Mercer street and a part of Bluefield avenue, with brick or block pavement.—J. T. Akers, Auditor.

Janesville, Wis.—Bids will be received for paving South River street with brick, comprising about 4,800 square yards.—A. E. Badger, City Clerk.

Contracts Awarded.—**Oakland, Cal.**—The contracts for street improvements have been awarded as follows: Grading Howe street, Blake and Bilger Company; improving Warder street and macadamizing Boehmer street, Hutchinson Company.—Frank R. Thompson, City Clerk.

Pueblo, Col.—The contract for 24,346 square yards of bitulithic paving in South Avenue district, has been awarded Warren Brothers Company, Boston, Mass.

Mayville, Ky.—The contract for street paving has been awarded Henkel and Sullivan of Cincinnati, O., at \$1.66 per square yard.

Portland, Me.—The contract for 9,000 square yards of bitulithic paving has been awarded the Warren Brothers Company, Boston, Mass.

Cumberland, Md.—The contract for paving Maryland avenue has been awarded Douglas P. Lefore and John T. Edwards, at \$44,191.

Ann Arbor, Mich.—The contract for 9,272 square yards of bitulithic paving has been awarded the Central Bitulithic Paving Company.

Detroit, Mich.—The Barber Asphalt Company has been awarded the contract for paving various streets, at a total cost of \$15,551.

St. Louis, Mo.—The contracts for new entrances for Washington boulevard at King's Highway and Union avenue, have been let. The designs are by Albert A. Groves and were provided for by the Washington Avenue Improvement Association, William Stix, President.

Fargo, N. D.—The contract for paving Broadway with cedar blocks has been awarded James Kennedy at \$34,500.—Samuel Crabb, City Engineer.

Canton, O.—The contract for paving and curbing Walnut street has been awarded Wm. and Calvin Turnbull; the contract for improving Schwalm street has been awarded John Skeels.

Cleveland, O.—A. J. Yawker and Company have the contract for eliminating the Big Four grade crossing at Clark avenue.

Huntington, W. Va.—Several streets will be paved; bids opened June 4.—John Corn, Chairman, Street Committee.

Chatham, Ont., Can.—The contract for 513 square yards of bitulithic paving has been awarded the Warren Paving Company.

Regina, Sask., Can.—The contract for paving South Railway street has been awarded the Warren Bituminous Paving Company, at \$44,000.

ROAD MAKING

Washington, D. C.—An appropriation of \$118,500 for county roads has been recommended by the Senate Committee.

Decatur, Ga.—An election will be held, August 22, to decide the question of issuing \$200,000, 5 per cent. road improvement bonds.

Brazil, Ind.—Bids will be received, June 11, for two gravel roads known as Hamilton road and Ringo road.—F. Frank Smith, County Auditor.

Sullivan, Ind.—Bids will be received for constructing twelve miles of road in Hamilton township.

St. Joseph, Mo.—The improvement of the Saxon and Agency road has been asked; macadam will probably be used.—Edward Moser, President, County Good Roads Association.

Rye, N. H.—The contract for constructing the State road has been awarded to Fred W. Stauers, Methuen, Mass., at \$6,150.—A. W. Dean.

Albany, N. Y.—The Good Roads bill has been signed by Governor Higgins, which appropriates \$50,000,000 for highway improvement.—Henry A. Van Alstyne, State Engineer.

Youngstown, O.—The contract for building four miles of macadamized roads has been awarded W. W. Kelly of McKeesport, at his bid of \$34,489.

Gatesville, Tex.—An election will be held to decide the question of issuing \$160,000 road improvement bonds.

Wheeling, W. Va.—The contract for paving Wheeling and Fairmont pikes has been awarded to F. T. Jones Company. Vulcan paving brick will be used.

SEWERAGE

Los Angeles, Cal.—The proposition to issue \$287,000 sewer bonds has been authorized.

Washington, D. C.—An appropriation of \$37,500 for cleaning and repairing sewer basins has been recommended by the Senate Committee.

De Land, Fla.—The citizens have voted to issue \$12,000 sewer bonds.

Muskegon, Mich.—Estimates are being prepared for a sewer system in District 6, at a cost of \$6,000.

St. Johnsville, N. Y.—Estimates are being prepared on a \$35,000 sewer system.

Barberton, O.—The estimated cost of the sewer system is \$38,347.

Cambridge, O.—Resolutions have passed Council to construct sanitary sewers on Clark, Twelfth, Third, Wall, Ninth, Eleventh, Blaine and other streets, and Beatty, Carlisle, Foster and Woodlawn avenues.—C. L. Blackburn, Clerk.

Canton, O.—Sanitary sewers on Wheeler and Walnut streets have been recommended.

Hamilton, O.—City Engineer Dillon is preparing plans for a storm water sewer on Maple street.

Monroeville, O.—Sewers will be laid in the streets to be paved.

New Philadelphia, O.—Plans will be prepared for constructing sewers for the western part of town.

Springfield, O.—Plans are being prepared for the North Side sewer system.

Wauseon, O.—A sewer will be constructed on East Elm street.

Yankton, S. D.—The citizens on the east and west sides have petitioned for extension of the sewer system.

Edmonton, Alta., Can.—It is reported that \$306,000 will be expended on sewer and water mains.

Port Hope, Ont., Can.—Estimates are being prepared for a sewer system.—The Street and Bridge Committee.

Proposed Work.—**De Land, Fla.**—The city has voted \$12,000 sewer bonds.

Indianapolis, Ind.—A sewer will be constructed in Palmer street.

Trenton, N. J.—It is proposed to construct a sewer in Bridge street.—Harry B. Salter, City Clerk.

Binghamton, N. Y.—Plans have been completed by Prof. Henry Ogden for a trunk sewer in the Fourth ward.

Jamestown, N. Y.—About \$5,000 will be expended on sewer construction.

Ashland, O.—The sale of \$10,000 sewer bonds will be advertised.

Cincinnati, O.—Sewers will be laid in Madison road, Calum, Cinnamon, Glenway, Winfield and Midland streets, at a cost of \$53,602.—C. M. Danenhower, City Engineer.

Cincinnati, O.—An issue of \$250,000 sewer bonds has been authorized.

Cleveland, O.—It is proposed to construct sewers in Eighteenth place, Beaver avenue, East Seventy-fifth street, Elton avenue, West Seventy-third street, Redman avenue, West Fourteenth street and East Seventy-third street.—Peter Witt, City Clerk.

Massillon, O.—Plans have been prepared by Engineer E. G. Bradbury, of Columbus, for the sewerage disposal plant for the State Hospital. Bids will be asked.

Sandusky, O.—The Warren street sewer will be constructed as originally planned; a sewer will be laid on Polk street.

Easton, Pa.—The Council proposes to issue \$175,000 sewer and other improvement bonds.

Terra Alta, W. Va.—A bond issue of \$15,000 for sewerage and paving will be made.

Winnipeg, Man., Can.—The city will spend \$372,610 on sewers.—H. N. Ruttan, City Engineer.

Contracts to Be Awarded.—**Moosehead, Ala.**—Bids will be received, June 6, for constructing sewers in several streets.—Julian Kendrick, City Engineer.

Washington, D. C.—Bids will be received, June 11, for constructing sewers.—Henry B. Macfarland, Commissioner.

Washington, D. C.—Bids will be received, June 18, for constructing a sewer.—Henry B. Macfarland, Commissioner.

Grand Rapids, Mich.—Bids will be received, June 15, for constructing the South End

sewer system, consisting of 51,400 feet of pipe sewer, 6 to 48 inches in diameter.—Board of Public Works.

Albert Lea, Minn.—Bids will be received, June 15, for constructing Teslow Ditch 14, at a cost of \$20,000.

Cape Girardeau, Mo.—Bids will be received, July 2, for constructing about twelve miles of sewers.—Geo. E. Campbell, City Clerk.

Brooklyn, N. Y.—Bids will be received, June 13, for constructing sewer in Fourth avenue from Eighty-second to Eighty-sixth street.—Bird S. Coler, Borough President.

Chillicothe, O.—Bids will be received, June 11, for constructing 1,500 linear feet, 8x9-foot reinforced concrete sewer, at an estimated cost of \$15,000.—H. M. Redd, City Engineer.

Marion, O.—Bids will be received, June 13, for constructing sewers in Blaine avenue.—Wm. Fries, Clerk.

Painesville, O.—Bids will be received, June 12, for constructing a storm water sewer in Erie street and Mentor avenue, also for seweraging South street and Liberty street.—O. W. Kile, Secretary, Board of Public Works.

Sandusky, O.—Bids will be received, the latter part of June, for constructing sewers, at a cost of \$30,000.—A. C. Schultz, City Engineer.

Medford, Ore.—Bids will be received, June 12, for installing sewer in District 5.—J. E. Taft, City Recorder.

Contracts Awarded.—**Elyria, O.**—The contract for constructing the Washington street sewer system and the Ohio street sewer has been awarded J. H. Hennessey, at his bid of \$3,000.

Ravenna, O.—The following contracts have been awarded: Sewer pipe, \$17,461, W. B. Stratton, Toronto, Can.; sewer disposal plant, \$48,432, Jas. McShaffrey, Akron; sewer system, \$37,684, Hanlon Construction Company, Cleveland.

Salem, O.—The contract for the Jennings avenue sewer has been awarded Perry and Miles, of Canton.

Toledo, O.—The contracts for sewers have been awarded as follows: \$15,000 sewer in Cottonwood, Patrick Tansey; \$5,800 sewer in Oakland street, Jno. McMahon.

Richmond, Va.—The contract for constructing sewer in Bacon's Quarter has been awarded Thomas A. Barry Company for \$10,000.

Saskatoon, N. W. T., Can.—The contract for furnishing the sewer pipe has been awarded W. F. Lee, at \$7,915.

WATER SUPPLY

Pueblo, Col.—The proposition to issue \$1,000,000 bonds for the purchase of a waterworks plant will be submitted to a vote of the people.

Rocky Ford, Col.—A waterworks system will probably be installed; a well will be drilled; machinery will be purchased.—A. P. Kendig, Superintendent.

Jackson, Ga.—The city has voted to issue \$16,000 additional water and light bonds.

Alton, Ill.—The Alton Water Company has increased its capital to \$400,000.

Rock Island, Ill.—It is recommended that a 2,000,000 gallon reservoir and a 3,000,000 gallon tower tank be constructed, at a cost of \$36,000.—City Engineer Olson.

Chickasha, Ind.—A bond issue of \$60,000 has been voted for a waterworks system.

Georgetown, Ind.—A company has been organized to construct a waterworks plant; capital, \$10,000.

Council Bluffs, Iowa.—The erection of a waterworks plant, instead of purchasing the old one, is recommended by the Council.

Louisville, Ky.—A company is being organized to construct a system of waterworks, to cost about \$10,000.

Bad Axe, Mich.—Council has been asked to extend waterworks mains on Port Crescent avenue.—Mayor Whitney.

Eyota, Minn.—An election will be held to decide the question of issuing \$10,000 waterworks bonds.

Torch, Minn.—An issue of \$15,000 waterworks bonds has been voted.—S. S. Clute, of St. Cloud, Engineer.

Kirkwood, Mo.—An election will be held, June 12, to decide the question of issuing \$25,000 waterworks bonds.

Whitefish, Mont.—An expenditure of \$30,000 will be made for a waterworks plant.

Dayton, O.—Steps will be taken to lay larger water mains, at a cost of \$200,000.—Maintenance Engineer McDargh, Waterworks Department.

Painesville, O.—The construction of \$75,000 filtration plant has been recommended.—Engineer Cummings, Water Service Board.

Bloomsburg, Pa.—A waterworks plant will be constructed.

Diamond, Pa.—The Diamond Water Company is considering the building of a reservoir.

Pittsburg, Pa.—Ordinances have been passed providing for the issue of \$500,000 bonds for extending water mains.

Elsinore, Utah.—The Council is arranging to issue waterworks bonds.

Cashmere, Wash.—An issue of \$10,000 for water supply has been voted.

North Yakima, Wash.—It is recommended that a proposal be submitted to the people to install an \$185,000 water system.

Carlyle, Sask., Can.—It is proposed to install a system of waterworks.—Cecil Godard, Engineer, Winnipeg, Man.

Yorkton, Man., Can.—A waterworks and sewer system is being considered.

Proposed Work.—**Pine Bluff, Ark.**—Steps are being taken to establish a municipal waterworks plant.

Napa, Cal.—It is proposed to construct a reservoir for the State Hospital, at a cost of \$30,000.—M. A. Nurse, Sacramento, Engineer to State Commissioners of Public Works.

Truckee, Cal.—About 4,000 feet of water pipe will be laid by the McGlashan Water Company.

Central City, Col.—Plans are being drawn to remodel the waterworks plant, at a cost of \$30,000.

Pueblo, Col.—The citizens have voted to issue \$1,000,000 waterworks bonds.

Hartford, Conn.—It is proposed to install an auxiliary water system for flushing streets and for better fire protection, at a cost of \$60,000.—Jos. M. Birmingham, President, Board of Water Commissioners.

Hartford, Conn.—It is proposed to lay a 10-inch main through Summit street, at a cost of \$7,000.—Jos. M. Birmingham, President, Board of Water Commissioners.

Chicago, Ill.—A 2-foot water main will be laid on Forty-fifth street, at a cost of \$60,000.—City Engineer Shaw.

Frankfort, Ind.—The Frankfort Water Company has received a 25-year franchise; improvements will be made, at a cost of \$20,000.

Hartford, Ind.—The drilling of additional wells is proposed by the Waterworks Commission.

Upland, Ind.—The waterworks plant will be rebuilt.—J. Bugher, President.

Kentwood, La.—It is proposed to install a waterworks plant.

Hillsdale, Mich.—An ordinance has passed Council for the issue of \$8,500 waterworks bonds.

Virginia, Minn.—Water mains will be extended in several streets by the Light and Water Company.

Ackerman, Miss.—Franchise has been granted Eugene Campbell for constructing a water and light plant.

Alton, Mo.—The waterworks system will be improved, at a cost of about \$200,000.

White Fish, Mont.—Plans are under way to construct a gravity water system; cost, \$10,000.

Oxford, Neb.—An election will be held, June 26, to decide on issuing \$18,000 water and light bonds.

New York, N. Y.—An additional water supply of 500,000,000 gallons daily will be furnished when work is completed in the Catskill mountains, at a cost of \$160,000,000. The State Water Commission has decided to give its consent to this plan.

Minot, N. D.—It is proposed to drill several wells to secure a water supply.

Anacortes, Wash.—A franchise has been granted to Will A. Lowman to construct a waterworks system.

Hoquiam, Wash.—Plans are under way to construct a 1,000,000 gallon reservoir, at an estimated cost of \$20,000.

Watcatchee, Wis.—The Council proposes to improve the water system.

Winnipeg, Man., Can.—The city will expand \$432,873 on waterworks extensions.—H. N. Ruttan, City Engineer.

Winnipeg, Man., Can.—Bids will be received for water pipe and special castings.—J. C. Gibson, Chairman, Fire, Water and Light Committee.

Montreal, Que., Can.—The Water Committee will erect two pumping stations to increase the capacity to 30,000,000 gallons daily.

Contracts to Be Awarded.—**Alturas, Cal.**—Bids will be received, June 25, for constructing waterworks, to cost about \$20,000.—John A. Voelckland, Town Clerk.

Washington, D. C.—Bids will be received, June 26, for erecting a steel standpipe, 42½ feet high, 36 inches diameter, at naval coal depot, California City Point.—Bureau of Supplies and Accounts, Navy Department.

Halley, Ida.—Bids will be received, June 30, for constructing a waterworks system, at a cost of \$25,000.—Leo Cramer, Clerk.

Rathdrum, Ida.—Bids will be received, June 9, for \$7,500 waterworks bonds.

Tallula, Ill.—Bids will be received, June 20, for constructing a waterworks system.—Owen Ford, Consulting Engineer, St. Louis, Mo.; F. F. Voight, Clerk.

Edgartown, Mass.—Bids will be received, June 11, for erecting a standpipe.

San Antonio, Tex.—Bids will be received, June 15, for constructing a waterworks extension at Fort Brown.—Lieut. Col. Robt. R. Stevens, Quartermaster.

Wanetta, Okla.—Bids will be received, July 2, for constructing waterworks.—O'Neil Constructing Company, Dallas, Tex., Engineers.

Leesburg, Va.—Bids will be received, June 19, for installing a waterworks system.—J. W. Bitzer, Mayor; R. H. Tebbs, Clerk.

Wyandotte, Wash.—Bids will be received, June 6, for material and labor to lay four and one-half miles of water mains.—James G. Pinson, Clerk.

Metustee, Wyo.—Bids will be received, June 11, for constructing a waterworks system; cost, \$10,000.—E. W. Hewitt, City Clerk.

Rio Grande du Sul, Brazil.—Bids will be received, October 15, for constructing water service and drainage.—President of Municipality.

Brandon, Man., Can.—Bids will be received, June 18, for 150 tons 6-inch c. i. pipe and specials, also hydrants.—W. H. Schillinglaw, City Engineer.

Contracts Awarded.—**Pontiac, Mich.**—The contract for building a 2,000,000 gallon reservoir has been awarded Heitsch Brothers, at \$10,000.

Windom, Minn.—Bids were opened, June 5, for constructing a septic tank.—W. M. Hale, Clerk.

Carthage, N. Y.—The contract for extending the water system on Washington and Clinton streets has been awarded John Thompson.

Manchester, Va.—The contract for constructing a filtration plant has been awarded the Federal Filtration System, New York, N. Y., at \$16,325.

Aurora, Ont., Can.—The contract for the street tower and tank for waterworks has been awarded Ontario Wind Engine and Pump Company, Toronto.

Indian Head, Sask., Can.—Contracts for the waterworks system have been awarded as follows: Wood pipe line and distribution, Fry and Masterson, Regina, \$20,554; sewerage system, Whiteman and Pike, Edmonton, \$11,925.56; dam and reservoir, W. Newman, Regina, \$7,476; wooden water pipe and castings, Canadian Pipe Company, Vancouver, \$20,469.40; cast iron water pipe, Canadian Foundry Company, Toronto, \$12,610.40; hydrants and valves, Canadian Fairbanks Company, Winnipeg, \$2,041.59.

PUBLIC LIGHTING

Goodwater, Ala.—Bids will be received for constructing a municipal electric-light plant at a cost of from \$12,000 to \$15,000.—J. S. Gilliland, President of Council.

Booneville, Ark.—A 30-year electric-light franchise has been granted the Robbeck Milling Company.

Eureka Springs, Ark.—An electric-light and power plant will be constructed by the Kings River Electric Light and Power Company.

Tallaton, Ga.—An election will be held to decide the question of issuing electric-light and water bonds.

Camp Point, Ill.—An election probably will be held to decide the question of issuing \$10,000 electric-light bonds.

Mason City, Ill.—The citizens have voted to issue \$10,000 municipal light bonds.

Springfield, Ill.—The electric-light plant will be improved and repaired.

Kendallville, Ind.—Bids will probably be called for constructing a \$25,000 electric-light plant.—A. B. Shepard, F. B. Perkins and Wm. Rolms, Directors.

Fort Dodge, Iowa.—The electric-light and power plant will be improved.

Belleville, Kan.—The contract for constructing a \$24,000 electric-light plant has been awarded W. A. Fuller, St. Louis, Mo.

Clay Center, Kan.—The Council is considering an electric-light or gas-light plant.

Kuttawa, Ky.—The construction of an electric-light and ice plant is being considered.

Paducah, Ky.—An appropriation of \$20,000 will be made for remodeling the electric-light plant.

Vicksburg, Miss.—Houghton Bros. have applied for franchise to construct an electric-light and power plant.

Elizabeth, N. J.—A municipal lighting plant is under consideration.—John S. Sauer, Chairman, Committee Finance and Light.

Jamesburg, N. J.—The Council has granted the electric-light franchise to the Manalapau Lighting Company.

Mooresville, N. C.—Plans are being made to construct a \$10,000 electric-light plant.—G. B. Bird, Asheville, Engineer.

Ellendale, N. D.—A gas plant will be constructed at a probable cost of \$10,000.—H. C. Peek, Secretary, Ellendale Light and Power Company.

Columbus, O.—The Finance Committee will be asked to appropriate \$140,000 for an electric-light plant.—Director Lied, Board of Public Service.

Ninety Six, S. C.—An electric-light and waterworks plant will probably be installed.

Emporia, Va.—The Electric-light and Power Company plant has been destroyed by fire, with a loss of \$120,000.—Andrew Pizinni, President.

Glace Bay, N. S.—The Council has decided to expend \$20,000 for electric-light purposes.

Proposed Work.—**Washington, D. C.**—Bids will be received, June 8, for electric-light plant, line material, boiler plate, wire rope, etc.—Isthmian Canal Commission.

Meridian, Ida.—It is proposed to construct an electric-light plant, to cost about \$10,000.—**Kendallville, Ind.**—Bids will shortly be asked for constructing a \$25,000 electric-light plant.—A. B. Shepard, F. B. Perkins, Directors.

Paducah, Ky.—An expenditure of \$20,000 has been authorized for electric-light improvement.

Athol, Mass.—The sum of \$15,000 has been appropriated for installing a municipal electric-light plant.—Eugene Lincoln, Templeton; C. Aymer Smith, Baldwinville, and C. H. Leathe, Otter River, Board in Charge.

Rush City, Minn.—An election will be held, June 12, to decide the proposition of issuing \$12,000 municipal electric-light bonds.

Ackerman, Miss.—An electric-light and water plant will be installed.

Lowell, N. C.—An electric-light plant will be constructed by the Spencer Mountain Mills.

Farmington, Utah.—The Hawkeye Light and Power Company is planning to install an electric-light and power plant, using water from Farmington Canyon, to furnish power.

Strathcona, Alta., Can.—Bids will be received for wire, arc lamps, regulators, etc.—A. J. McLean, Town Engineer.

St. Johns, N. B., Can.—A municipal electric-light plant will be installed at a cost of \$121,000.

Owen Sound, Ont., Can.—The citizens have voted an expenditure of \$45,000 for an electric-light plant.

Contracts Awarded.—**Spray, N. C.**—An electric-light and waterworks plant will be installed by Frank Mebane and M. G. Wilson.

Brooklyn, N. Y.—The contract for the electric equipment in addition to School 109 has been awarded the Yorkville Electric Company, at \$15,276.

Cleveland, O.—The Lincoln Park Management has awarded the contract for a \$40,000 lighting plant.

Winnipeg, Man., Can.—The contract for electric lighting has been awarded the Winnipeg Street Railway Company.

FIRE EQUIPMENT AND SUPPLIES

Washington, D. C.—An appropriation of \$40,000 for a fire station is recommended by the Senate Committee.

Chicago, Ill.—The laying of high-pressure mains in the "loop section" is urged by the Credit Men's Association.

Duquoin, Ill.—A volunteer fire company has been organized.—Robert Plumlee, Chief.

Oklahoma City, Okla.—Plans have been prepared by Arthur Williams for a \$10,000 fire station.

Kansas City, Kan.—It is recommended by the Fire Chief that \$300,000 bonds be issued for improving fire service.

Wichita, Kan.—Plans will be prepared to erect a Fire Department building, at a cost of \$15,000.

Eloise, Mich.—The County Commissioners have asked an appropriation to purchase hose for fire protection at the Infirmary.

Owosso, Mich.—The Council has asked for an appropriation to purchase a fire steamer and hose.

Owosso, Mich.—The question of issuing \$25,000 fire improvement bonds will be submitted to a vote of the people.

White Park, Minn.—It is proposed to purchase additional fire apparatus.

Joplin, Mo.—The matter of purchasing an aerial fire truck is under consideration.

Kansas City, Mo.—The erection of a fire station, repairs to old ones and purchase of additional equipment have been recommended by the Mayor.

Irvington, N. J.—It is recommended that six fire-alarm boxes be added.—Chairman Webb, Fire and Water Commissioner.

Little Silver, N. J.—A fire company has been organized with W. H. Carhart, President. About 500 feet of hose will be purchased, also a combination chemical wagon.

Haverstraw, N. Y.—Fire police have been organized, taking one man from each fire company.

Fremont, O.—Plans are being prepared for an automatic fire-alarm system, including a pump, which will cost about \$10,000.

Johnstown, Pa.—Improved fire protection has been asked for, including the installing of a 36-inch water main.—Charles S. Price, Director, Board Water Works.

Dallas, Tex.—The Fire Chief has recommended the purchase of a hook and ladder truck and the organization of a fire company in the ninth ward; also the erection of a fire station in North Dallas and equipment for the same.

Dallas, Tex.—It is recommended by the Fire Chief that larger water mains be laid around Fair Park.

West Allis, Wis.—A Fire Department has been organized.

Proposed Work.—**Savannah, Ga.**—The Fire Committee will expend \$5,000 on a fire alarm system.

Jasonville, Ind.—The Council proposes to improve the fire protection.

Brockton, Mass.—An appropriation of \$18,000 has been made for a station and for the purchase of a combination wagon.

Pontiac, Mich.—It is proposed to improve the fire protection.—Mayor Guillot.

New York, N. Y.—Engine house No. 1 is to be enlarged at a cost of \$24,000.—John H. O'Brien, fire Commissioner.

Cleburne, Tex.—A fire engine will be purchased.

Dallas, Tex.—Bids will be received, June 12, for furnishing second size steam fire engine, and heater and a hose wagon, capacity 1,000 feet 2½-inch hose.—J. E. Brisslett, City Secretary.

Puyallup, Wash.—The engine house will be enlarged and fire apparatus will be purchased.

Seattle, Wash.—The Council will improve the fire protection at the docks of the Great Northern Railway Company.

Regina, Sask., Can.—A fire hall will be erected at a cost of \$10,000.

MUNICIPAL BUILDINGS

Gadsden, Ala.—An ordinance has been passed calling an election, June 18, to decide the question of issuing \$15,000 school bonds.

Jonesboro, Ark.—Plans have been completed for a courthouse in Craighead County, cost \$28,000.

Carrollton, Cal.—The proposition to issue \$4,000 school bonds will be submitted to a vote of the people on June 9.

Atlanta, Ga.—An issue of \$300,000 school bonds will probably be made.

Atlanta, Ga.—The issuance of \$450,000 for erecting a Town Hall and auditorium will be asked.

Chicago, Ill.—It is recommended that the school board be given power to issue the necessary bonds for buildings. John G. Fexter, Chairman Finance Committee.

Flora, Ill.—An election will be held to decide the question of issuing \$9,000 school bonds.

Virginia, Ill.—An expenditure of \$20,000 for school heating apparatus has been approved.

Winthrop Harbor, Ill.—Plans have been prepared for erecting a school house.—T. J. Fossland, Clerk Board of Education.

Bokchito, I. T.—Plans are being prepared for a school building to cost \$6,500.—T. M. Little, Architect.

Haskell, I. T.—The proposition to issue \$10,000 school bonds will be submitted to a vote of the people.

Weleetka, I. T.—Plans are under way for the erection of a school building.

Minneapolis, Minn.—An appropriation of \$25,000 has been asked for public baths.—Alderman Lara M. Rand.

Meridian, Miss.—An issue of \$35,000 school bonds will be made.

Seymour, Mo.—The citizens have voted to issue \$3,000 school bonds.

Boliver, N. Y.—An election will be held to decide the question of issuing school bonds.

Fairport, N. Y.—Efforts will be made to secure an appropriation for the erection of an annex to the high school.

St. Johnsville, N. Y.—The question of issuing \$34,000 school bonds will be submitted to a vote of the people.

Glasston, N. D.—An issue of \$4,000 school bonds has been voted.

Plattsburgh, Pa.—An appropriation of \$45,000 has been made for the Marine Hospital.

Huntsdale, Tex.—An election will be held to decide the question of issuing bonds for rebuilding the school house.

Proposed Work.—**Copeland, Ida.**—The proposition to issue \$12,000 school bonds carried.

Lafayette, Ind.—The issue of \$1,000 school bonds has been voted.

Boyton, I. T.—An election will be held, June 12, to decide the question of issuing school bonds.

South McAllister, I. T.—The proposition to issue \$175,000 school and waterworks bonds, carried.

Independence, Kan.—The courthouse will be improved at a cost of about \$25,000.

Whitman, Mass.—A Town Hall costing \$97,000 will be erected.—A. D. B. Butler, Chairman Building Committee.

Jackson, Minn.—Bids will be received for erecting a courthouse to cost about \$80,000.—Board County Commissioners.

Rochester, N. Y.—Bids are advertised for the purchase of \$18,000 school bonds.

Carthage, S. D.—An issue of \$4,000 school-house bonds has been authorized.

Mertens, Tex.—An issue of \$5,500 school-house bonds has been authorized.

Roseland, Tex.—An issue of \$15,000 school bonds has been authorized.

Shell Lake, Wis.—An issue of \$8,000 Town Hall bonds has been authorized.

Hartney, Man., Can.—An appropriation of \$5,000 has been made to complete the City Hall.

Winnipeg, Man., Can.—Public buildings will be erected as follows: Military stores building, \$15,000; military building, non-commissioned officers, \$6,000; post-office, \$200,000; postal station, \$30,000; immigration building, \$47,000.

Wolseley, Man., Can.—A Town Hall and fire station will be erected at a cost of \$20,000.

Peterboro, Ont., Can.—A schoolhouse will be erected at a cost of \$54,000.

Regina, Sask., Can.—Barracks will be built for the Strathcona Horse at a cost of \$40,000.

Calgary, N. W. T., Can.—A labor temple will be erected at a cost of \$25,000, to be used by the Trades and Labor Councils.

Glace Bay, N. S.—The council will expend \$35,000 for school buildings.

Contracts to Be Awarded.—**Fort Oglethorpe, Ga.**—Bids will be received June 20, for constructing a morgue building in connection with the hospital.—Capt. H. D. Berkely, Quartermaster.

Chicago, Ill.—Bids will be received June 8, for two electric dumb waiters.—Directors Public Library.

Dixon, Ill.—Bids will be received June 15, for constructing a city building.—Henry U. Bardwell, City Clerk.

Rockford, Ill.—Bids will be readvertised, June 11, for heating, lighting and plumbing work on high school.

Whitesburg, Ky.—Bids will be received June 11, for constructing a jail building of stone or brick, to cost from \$8,000 to \$10,000.—H. T. D., Probate Judge.

East Longmeadow, Mass.—Bids will be received June 6, for constructing an addition to the Center School.—L. C. Fay, Architect.

St. Paul, Minn.—Bids will be received June 13 for heating plant in Longfellow School and plumbing in Murray School.—Board of School Inspectors.

Elmira, N. Y.—Bids will be received June 9 for a lot wall at U. S. Court House and Post-office Building.—James Knox Taylor, Supervising Architect, Washington, D. C.

Sumter, S. C.—Bids will be received June 19 for erecting a Courthouse at a cost of \$90,000.—Edwards and Walter, Architects, Columbia, S. C.

Temple, Tex.—Bids will be received June 8 for the purchase of \$25,000 school bonds.

Contracts Awarded.—**Woodsfield, O.**—The contract for the Courthouse has been awarded Robert H. Evans & Co., Zanesville, at \$126,000.

Philadelphia, Pa.—The contract for erecting the State Hospital at Spring City has been awarded John R. Wiggins and Company at \$412,400; of this amount \$48,000 is to be used for lawns and grading.

Bristol, Tenn.—The contract for erecting the Northeast Bristol school will be awarded Kingslover and Huddle.

Spokane, Wash.—The contract for the Federal Building to be constructed at Los Angeles has been awarded Hastic and Duigan; cost, \$1,000,000.

Madison, Wis.—F. L. Fuller & Co., Cleveland, O., were awarded the \$30,000 school bonds.

Medicine Hat, N. W. T., Can.—The contract for the \$35,000 postoffice was awarded H. K. Oakes and J. D. Everard.

BRIDGES

Fresno, Cal.—The Edison Power Company will build a bridge at Trimmers' Springs at a cost of \$15,000.

Marysville, Cal.—The county supervisors are considering the plan to construct a steel bridge across the Feather River.

Washington, D. C.—The Senate has passed a bill authorizing the Pend d'Oreille Development Company to bridge the Pend d'Oreille River.

Aurora, Ill.—The estimated cost of bridge over river at Fox street is \$42,000.

Moline, Ill.—It is recommended that the bridge spanning Eleventh avenue near Thirtieth street be rebuilt with steel flood beams, concrete abutments and iron guard railings in accordance with plans. Bids will be advertised for.

Ottawa, Ill.—The Council is considering ways and means for rebuilding the bridge across the Illinois River.

Jeffersonville, Ind.—The building of a bridge in Owen township is being considered by the Clarke County Commissioners.

St. Paul, Minn.—An ordinance is before Council authorizing an issue of \$100,000 bridge bonds.

Natchez, Miss.—The Council is considering the building of a bridge across the bayou on Hamchitto street.

St. Louis, Mo.—An election will be held June 12, to vote on the proposition to issue \$11,200,000 for the purpose of building and maintaining a free bridge across the Mississippi River, and for other public improvements.

Lincoln, Neb.—The County Commissioners are considering the matter of building a bridge over Antelope creek.

New York, N. Y.—Plans will be prepared

for a masonry viaduct over the Dyckman street valley, to form part of the extension of Riverside Drive to the Henry Hudson Memorial; cost, \$2,500,000.—John F. Ahearn, President, Borough of Manhattan.

Dayton, O.—An ordinance has been passed to issue \$2,000 bonds to construct a temporary bridge at Washington street.

Toledo, O.—Preliminary and detailed plans for the river bridge will be drawn by Engineer Osborne of Cleveland.

Beeville, Tex.—Arrangements are being made to construct a steel bridge across Blanco creek.

Milwaukee, Wis.—The Council will be asked to pass a resolution transferring \$20,000 or \$30,000 from the bridge construction fund to the bridge repair fund in order to repair bridges at Folsom, Cherry, Buffalo, Michigan and other streets.—City Engineer Bechter.

Nashotah, Wis.—Plans have been prepared for constructing a viaduct over the tracks of the Milwaukee railroad.

Campbelton, N. B., Can.—A charter has been granted Thomas Malcolm to build a railway and passenger bridge across the Restigouche river at a cost of \$600,000.

Proposed Work.—**Gadsden, Ala.**—The Louisville and Nashville Railway Company are preparing plans for a bridge across the Corsa River.—W. H. Courtenay, Chief Engineer, Louisville, Ky.

Fresno, Cal.—The plans for the reinforced concrete bridge at Skaggo crossing have been rejected.—A. D. Ewing, Clerk, Board of Supervisors.

Newport, Ind.—It is proposed to issue \$12,000 bonds for erecting a bridge across the Wabash River.

Berry, Ky.—A bridge 258 feet long will be built across South Licking River.—L. W. Swan, Bridge Commissioner.

Lawrence, Mass.—Plans have been completed for the bridge over the Merrimack River.—A. D. Marble, City Engineer.

Springfield, Mo.—Plans have been completed for bridges over the Jordan River at an estimated cost of \$2,000 to \$5,000.

Elizabeth City, N. C.—The Norfolk and Southern Railroad is planning a 5½-mile steel bridge across Albemarle Sound with a middle span high enough to allow vessels to pass. The plans have been sent to the War Department for approval.—M. K. King, Norfolk, Va., General Manager; J. A. Barron, Supervisor of Bridges, Berkley, Va.

Roanoke Rapids, N. C.—A steel bridge will be constructed across the Roanoke River at a cost of \$30,000.

Dayton, O.—The Council has authorized an appropriation of \$2,000 for a temporary dam at the Washington street bridge.—C. A. Snyder, Mayor.

Frederickstown, O.—A bridge will be built at Taylor street and another on Grant street; both bridges will be cement.

Toledo, O.—Bids will be received for building a steel highway and electric bridge 60 feet wide to replace the present structure over Ten Mile creek.

Zanesville, O.—A highway bridge will be built across Jonathan creek.—L. E. Brexford, County Auditor.

Clarksville, Tenn.—A bridge will be erected across the Cumberland River.

Knoxville, Tenn.—Plans have been completed for concrete arches on Grainger and Glenwood avenues across First Creek.—W. C. Crozer, City Engineer.

Houston, Va.—The Roanoke Rapids Bridge Company will build and maintain a toll or free bridge across the Roanoke River. Capital, \$50,000.—H. C. Carper, president.

Winnipeg, Man., Can.—A bridge will be constructed over the Red River at Redmond street.

Contracts to Be Awarded.—**Lakeport, Cal.**—Bids will be received July 2 for erecting a steel bridge across Scotts Creek.—O. A. Wilson, Oakland, Engineer.

Oakland, Cal.—Bids will be received June 14 for constructing a concrete bridge across Cottonwood creek.—John P. Cook, Clerk Board Supervisors.

Alamoso, Col.—Bids will be received June 16 for constructing a wagon bridge across the Rio Grande River.—T. W. Jaycox, State Engineer, Denver, Col.

Wilmington, Del.—Bids will be received June 4 for constructing a concrete steel bridge over Brandywine creek at Van Buren street.—Theodore A. Leisen, Chief Engineer.

Washington, D. C.—Bids will be received June 16 for constructing four steel and concrete bridges.—Henry B. F. Macfarland, Henry L. West and John Biddle, Bridge Commissioners.

Danville, Ill.—Bids will be received June 9 for constructing a bridge over Rutan ford; cost \$2,500.

South Bend, Ind.—Bids will be received June 12 for constructing two Melan arch bridges to cost \$90,000 and \$85,000 respectively.

Berry, Ky.—A bridge will be constructed across South Licking river.

Brockton, Mass.—The New York, Brockton and Boston Canal and Transportation Company have petitioned for a charter to construct a canal from Fall River to Boston.

Morgan City, La.—Bids will be received for dredging a 15-foot channel through Point au Fer Reef at mouth of Atchafalaya Bay.—Atchafalaya Bay Ship Canal Company.

Sedgwick, Kan.—Bids will be received June 12 for constructing a bridge over Sand creek.—B. O. Hagan, County Clerk.

Leland, La.—Bids will be received July 1 for constructing four steel bridges.—J. C. Hardin, Clerk of Police Jury.

Cape May, N. J.—Bids will be received June 14 for stone and steel bridge.—R. Fennell Smith, County Engineer.

Newark, N. J.—Bids will be received June 21 for constructing a bridge over the Passaic River.

New York, N. Y.—Bids will be received July 1 for constructing approaches to the Blackwell's Island bridge; cost \$3,000,000.

Le Sourdsville, O.—Bids will be received June 12 for constructing two aqueducts.—Charles E. Perkins, Chairman Board Public Works.

Seymour, Wis.—Bids will be received June 11 for constructing a stone arch bridge, known as the Heckel Bridge.—A. Kolb, Chairman Bridge Committee.

Cornwall, Ont., Can.—Bids will be received June 18 for two bridges to be built of steel and masonry.—Adrian T. McDonnell, County Clerk.

Contracts Awarded.—**Pueblo, Col.**—The contract for five steel bridges on the Royal Gorge division of the Canon City, Florence and Interurban Electric Company has been awarded the Bullen Bridge Company.

Waddams Grove, Ill.—The contract for the bridge over the Pecatonac River has been let to W. H. Shons, at \$11,949.

Okmulgee, I. T.—The contract for the bridge across the Canadian River has been awarded A. J. Branson, Ennis, Tex.

Cambridge, Mass.—The contract for erecting towers on piers 5 and 6 Cambridge Bridge has been awarded Jones and Meehan, at \$9,940.

Taunton, Mass.—The contract to construct a bridge over Three Mile River has been awarded Magee and Macomber.

Watertown, Mass.—The contract for building a temporary bridge at Galen street has been awarded A. B. Murdough, at \$4,438.—W. F. Learned, Town Engineer.

Worcester, Mass.—The contract for constructing the Boston and Maine Railway bridge at Sterling Junction has been awarded the Eastern Bridge and Structural Company.

Columbus, Miss.—Bids were opened June 4, for rebuilding bridge across Jim creek, also a bridge on Catalpa creek. D. D. Richards, Clerk.

Indianola, Miss.—The contract for the steel draw-bridge across Sunflower River has been awarded the Southern Bridge Company of Birmingham, Ala., at \$25,400.

Bristol, N. H.—The contract to erect a steel and concrete bridge has been awarded the United Construction Company at \$4,525.

Niagara Falls, N. Y.—The contract for constructing a bridge over Erie avenue was awarded the New Jersey and West Virginia Bridge Company at \$34,338, the contract for the Fourth street bridge was awarded the Buffalo Structural Steel Company at \$5,432 and the canal bridge contract was awarded W. S. Humbert at \$45,062.50.

Osborn, O.—The contract for the steel bridge has been awarded the Canton Bridge Company at \$7,330.

Castlewood, S. D.—The contract for building seven steel bridges has been awarded the Clinton Bridge and Iron Works at \$6,249.—F. A. Trum, Deputy Auditor.

Corpus Christi, Tex.—The contract for the iron bridge over the Neces River has been awarded C. Q. Horton, Austin, at \$6,394.

Houston, Tex.—A bridge will be constructed across Virginia Point to Island of Galveston, by the Galveston Toll Bridge and Causeway Company.

Louisiana, Va.—The contract for the bridge to connect Orange and Louisa counties has been awarded the Virginia Bridge and Iron Company of Roanoke.

Colfax, Wis.—The contract for the bridge over the Mackinaw River, has been awarded Burnham and Ives, Bloomington, at \$3,970.

STREET RAILWAYS

Washington, D. C.—The Washington, Baltimore and Annapolis Electric Railway propose to construct a line to Baltimore. About \$4,000,000 will be spent in constructing and equipping the line.

Jackson, Miss.—An electric line will be extended to Duttonville.

Rapid City, S. D.—F. M. Kerns, Hundred, W. Va., has been granted a franchise to install a trolley system.

For Machines to Drill, Blast and Test Holes and Water Wells, write "LOOMIS CO., TIFFIN, O."

Chattanooga, Tenn.—The Chattanooga Electric Company will expend between \$5,000 and \$10,000 for improvements.

Austin, Tex.—The Trinity and Brazos Valley Railway Company has petitioned for authority to issue \$404,000 temporary mortgage bonds.—Col. Frank Andrews, Houston, General Attorney.

Spokane, Wash.—An electric railway is being planned to be built along the Pend d'Oreille River.—Incorporators, Edgar A. Torrence, David T. Ham and Wilbur S. Yearsley.

Rhinelander, Wis.—E. A. Edmunds has asked for franchise for an electric line.

Proposed Work—Forest City, Ark.—It is proposed to build an electric line to Clear Lake.—B. J. Thompson, Promotor.

Newark, Del.—A franchise has been granted the Delaware Interurban Railway Company to build a line from Wilmington to Elkton, Maryland, to be completed June, 1907.

Indianapolis, Ind.—The Randall-Morgan syndicate will construct an electric line between Richmond, Ind., and Dayton, O.; also a line will be constructed through New Castle, Greenfield and Middletown.—Hugh J. McGowan, Indianapolis; W. Kelsey Schoepf, Cincinnati.

Bay City, Mich.—Bids will be received for furnishing materials, grading, drawing and paving right of way of Bay City Traction and Electric Company, on Broadway, Fremont avenue, South Center street.

Gulfport, Miss.—The Street Railway Company proposes to build an extension on Twenty-fifth avenue.—Jos. T. Jones, President.

Yazoo City, Miss.—An issue of \$50,000 bonds has been voted for an electric street car system.

White Plains, N. Y.—Plans are under way to organize a street railway company for the purpose of building an extension to the subway from Van Cortland Park to Getty Square, Yonkers; capital, \$1,000,000.—Ex-Mayor Leslie Sutherland.

Akron, O.—The Wadsworth and Western Traction Company has increased its capital to \$500,000 and will build an extension through Medina, Ashland and Richland.

IN THE MARKET

At Home.—J. F. Ball & Bro., Ball, La., wants a 500-light dynamo with switchboard and connections.

Seth S. Barnes, Marston, Mo., wants machinery for digging ditches.

J. A. Bel Lumber Co., Lake Charles, La., wants eight to twelve miles of steel rails, thirty to thirty-five pounds; also a twenty-four-ton locomotive.

J. H. Crutchfield, 238 People's Building, Atlanta, Ga., wants a second-hand Corliss engine 16 x 42.

Electric Manufacturing and Equipment Co., Atlanta, Ga., wants blue Vermont marble switchboard panels.

Otho Fowler, Kuttawa, Ky., wants machinery for a 1500-incandescent-light plant. C. A. Gambrill Manufacturing Co., 225 Commerce Street, Baltimore, Md., wants portable fire-escapes.

T. J. Jones, Chrome, N. J., wants a 200 to 250 kw. alternating-current dynamo.

H. H. Leslie & Co., Leesburg, Va., wants cast-iron water pipes, fire hydrants and lead.

Ed. A. Lowry, Cedartown, Ga., wants evaporating machinery.

The Juniata Furnace and Foundry Co., Newpurt, Pa., wants a $\frac{3}{4}$ -yard bucket steam shovel.

J. W. Kelley & Co., 13 West Ninth Street, Chattanooga, Tenn., wants an electric freight elevator.

A broad.—CALAIS, FRANCE.—The City Council intends to build an ice factory and will want ammonia refrigerating machinery. Address No. 150 Bureau of Manufactures, Washington, D. C.

LONGDOZ, BELGIUM.—The Société de l'Esperance intends to erect a central station with steam turbines and dynamos to produce electric power for its forges. Address No. 151 Bureau of Manufactures, Washington, D. C.

MUNICIPAL JOURNAL AND ENGINEER

PARKS

Wilmington, Del.—Plans have been submitted for a small park at southeast corner of Third and Tatnall streets.—Howard D. Ross, Councilman.

Wilmington, Del.—It is recommended by Park Commissioners that additions be made to Brandywine Park, between Rodney and Clayton streets, and extending to Gilpin avenue, at a cost of \$3,500.

Crookton, Minn.—Extensive plans are under way for parks along the Red Lake River in addition to the present city park.

Kansas City, Mo.—Plans to improve Snope Park are as follows: Zoological gardens, \$10,000; ten or fifteen miles of roadways; lake with boathouse; pavilion and swimming pools; viaducts over Blue river and railroad tracks; public golf links or other athletics. An appropriation of \$500,000 will be asked for parks, \$150,000 to be used for Snope Park.

Kansas City, Mo.—Arrangements are being made for improvements in all parks and parkways; about \$76,526 will be spent.—Franklin Hudson, President Park Board.

New York, N. Y.—Initial steps have been taken to create a public park around Grant's tomb, Riverside, New York. It is proposed to take in several blocks, at a cost of \$2,000,000 or \$3,000,000.

GARBAGE WASTE AND DISPOSAL

Wilmington, Del.—Bids will be received, June 28, for collecting and removing garbage and for garbage disposal.—John J. Monaghan, Clerk.

Sandusky, O.—The question of a garbage disposal plant is being considered.

Springfield, O.—A garbage disposal plant costing \$15,000 is proposed.

Steubenville, O.—James Coyne was the lowest bidder for constructing the garbage plant; the Universal Eng. Contracting Company was the lowest bidder on the furnaces.

Indianapolis, Ind.—The contract for collection of garbage and removal of dead animals has been let to the Indianapolis Sanitary Company, at \$52,000.

Philadelphia, Pa.—Bids will be received, June 13, for cleaning streets, removing ashes, household waste, garbage and dead animals.—Thomas L. Hicks, Director, Public Works.

WANTS

Situations Wanted

DRAUGHTSMAN—(Mechanical) designer; age 30; graduate mechanical engineer; nine years' office, two shop, on jigs, fixtures, instruments, special machinery; energetic hustler; start immediately; location immaterial. Address A508, Municipal Journal.

DRAFTSMAN'S HELPER.—By young man; steady position. FELIX WASELKOWSKI, 103 Pearsall st., Blissville, Long Island City.

ELECTRICAL DRAFTSMEN—Accurate mechanical; permanent positions. Address A534, Municipal Journal.

Situations Vacant

ARCHITECTURAL draughtsman; six years' experience factory and tenement work. Address A526, Municipal Journal.

WANTED—Competent draughtsman of some experience to take charge of draughting room; state experience, references and salary. Address A500, Municipal Journal.

TIMEKEEPER—For building contractor; must give reference as to honesty; experience not essential. Address A501, Municipal Journal.

TRACER—Neat and rapid, familiar with mill machinery drawings. Send sample of work. Address A502 Municipal Journal.

DRAFTSMEN—We want capable draftsmen of either electrical, mechanical or general experience; if you would like to change your position or its location, write and tell us about the character and extent of your work. Address, giving full particulars, A533, Municipal Journal.

WANTED—An Engineer for small electric-lighting plant; must do own firing. Address A534, Municipal Journal.

ENGINEER—Competent man wanted for steam and electrical plant; first-class man only need apply; state experience, references and salary expected; plant located in New York, short distance from city. Address A533, Municipal Journal.

BUILDING material salesman for plaster, side line, Jersey, Bronx, up town, Long Island; territory to good man; state experience, references. Address A532, Municipal Journal.

MISCELLANEOUS

Columbus, O.—The estimate of expenses of various city departments calls for \$133,000.

Freewater, Ore.—The Tumalum Mutual Telephone Company has been organized and will extend its lines to Walla Walla.—F. J. Bodefelt, President.

Pittsburg, Pa.—The appropriation for the Herr Island dam on the Allegheny is \$281,226.63.

Pittsburg, Pa.—An appropriation of \$389,196 has been asked for Dam No. 3 on the Monongahela river.

Meadville, Pa.—G. B. Morse and J. B. Frauenthal of Cleveland, O., have prepared plans for the improvement of French creek.

Houston, Tex.—An election will be held, June 21, to decide the question of issuing \$143,700 municipal bonds.

Lake City, S. C.—The city has voted to issue \$20,000 bonds for public improvements.

Rigaud, Que., Can.—The town is offering inducements to any industry which will be satisfactory to the people, as follows: A bonus of \$12,000 cash; 15 years' exemption from taxes; free water power for 10 years, and building site free.

IN our special SEWERAGE number, issued on May the 2nd, we ventured to congratulate ourselves on the great improvement both in the literary matter and the manner of the production of the issue itself, overreaching as it did any of its preceding numbers. Again we congratulate ourselves, for the reason that this special PAVING number is even far ahead of the other. Never—as far as we can trace—has there been gotten together in any magazine so much interesting original signed matter covering every phase of PAVING work. It is a perfect encyclopedia of PAVING, and, of course, of inestimable value to all interested in this important subject. We shall still go on improving in quality and increasing in quantity until we reach the high standard for which we are striving. The growth of the business or commercial end of the paper will also bear well looking into. This issue contains a large number of new pages of advertising quite in character with the rest of the publication, showing that our efforts are appreciated and that it pays to advertise ALL THE TIME in the MUNICIPAL JOURNAL AND ENGINEER, which thoroughly covers all the varied fields of Construction, Supplies and Utilities.

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